

94-2
94th Congress }
2d Session }

COMMITTEE PRINT

OCEAN MANGANESE NODULES

[SECOND EDITION]

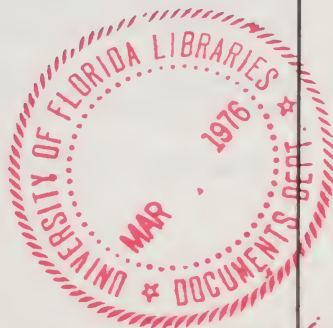
PREPARED BY THE
CONGRESSIONAL RESEARCH SERVICE

AT THE REQUEST OF

HENRY M. JACKSON, *Chairman*
COMMITTEE ON INTERIOR AND
INSULAR AFFAIRS
UNITED STATES SENATE



FEBRUARY 1976



Printed for the use of the
Committee on Interior and Insular Affairs

U.S. GOVERNMENT PRINTING OFFICE

65-675 O

WASHINGTON : 1976

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(II)



MEMORANDUM OF THE CHAIRMAN

To Members of the Senate Interior and Insular Affairs Committee:

The question of who owns, or is responsible for, the two-thirds of the earth, which lies under the oceans, has concerned me since 1969 when I appointed Senator Lee Metcalf to head a Special Subcommittee on the Outer Continental Shelf.

Since then, the Committee on Interior and Insular Affairs has held hearings on the general subject and on specific legislation. We also have monitored the Third United Nations Conference on the Law of the Sea and its preparatory meetings. As Chairman of the Subcommittee on Minerals, Materials and Fuels, Senator Metcalf has continued to provide constructive leadership.

We share a sense of urgency about a source of minerals from the oceans—minerals basic to our economy—minerals which now come almost exclusively from foreign sources—minerals which we can discover and have a right to develop under existing international law and with due regard to the other uses of the oceans.

There is increasing pressure by many nations for stringent limitations on access to raw materials lying within their borders and increased prices for those raw materials which are made available to industrial nations. These nations call these policies steps to a “new economic order.” We call them cartels.

Some of these minerals are contained in the manganese nodules which literally pave the ocean floor in many parts of the world. With increased public awareness of the importance of the nodules as our mineral supply came also a need for what I would call a primer. In 1975, I asked the Congressional Research Service of the Library of Congress for such a document. The Committee print of that report was widely circulated and is now out of print.

The second edition of that report, updated by the Congressional Research Service, follows. I commend it to the attention of those interested in this vital and complex subject.

HENRY M. JACKSON, *Chairman.*



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LETTER OF TRANSMITTAL

THE LIBRARY OF CONGRESS,
CONGRESSIONAL RESEARCH SERVICE,
Washington, D.C., January 20, 1976.

HON. LEE METCALF,
Chairman, Subcommittee on Minerals, Materials and Fuels, Committee on Interior and Insular Affairs, U.S. Senate, Washington, D.C.

DEAR SENATOR METCALF: In response to your request, I am submitting an updated version of the primer on manganese nodules published in June 1975.

This report, titled "Ocean Manganese Nodules, Second Edition," reflects recent events and the issues brought out in the October and November hearings of your committee and ties them into the past record. The primer is intended to serve as a background report on deep seabed mining covering such topics as location of manganese nodule deposits, site evaluation, technology of mining nodules, economic implications, commercial interests, government activities, foreign activities and legislative history. As the outcome of the Third U.N. Conference on the Law of the Sea is not yet clear and several hurdles with regard to deep seabed mining remain to be cleared, possible treaty implications to the United States are also considered.

This report was prepared by Dr. James E. Mielke, Analyst in Marine and Earth Sciences of the Science Policy Research Division.

We hope this report serves your committee's needs as well as those of other Members of the House and Senate in the consideration of interim domestic legislation to encourage and regulate deep seabed mining until an acceptable Law of the Sea treaty is attained.

Sincerely,

NORMAN BECKMAN, *Acting Director.*

OCEAN MANGANESE NODULES

[Second Edition]

Prepared by

James E. Mielke

Science Policy Research Division

Congressional Research Service

Library of Congress

at the Request of

HENRY M. JACKSON, *Chairman*

Committee on Interior and Insular Affairs

United States Senate

February 1976

CONTENTS

	Page
Memorandum of the Chairman.....	III
Letter of transmittal.....	V
Summary.....	XIII
I. Introduction.....	1
II. Composition, formation, and distribution of manganese nodules.....	3
Shape.....	3
Surface texture.....	4
Structure.....	4
Composition.....	5
Elemental composition.....	5
Mineralogy.....	6
Formation of manganese nodules.....	6
Biological origins.....	6
Inorganic origins.....	7
Geographical distribution.....	7
North Pacific Ocean.....	11
South Pacific Ocean.....	12
North Atlantic Ocean.....	12
South Atlantic Ocean.....	12
Indian Ocean.....	12
III. Mining: Site selection, technology and processing.....	13
Mine site selection.....	13
Nodule mining technology.....	15
Air-lift pumping.....	15
Hydraulic lift.....	18
Mechanical lift.....	18
Nodule processing technology.....	20
Hydrochlorination.....	21
Sulfur dioxide roasting and water leaching.....	22
Ammoniacal leaching.....	23
Sulfuric acid leaching.....	24
Smelting.....	25
IV. Environmental concerns.....	27
Previous research.....	27
Specific effects.....	27
Repopulation.....	27
Transplantation.....	28
Surface water contamination.....	28
Pollution from shipboard processing.....	29
Common effects.....	29
Findings and further investigations.....	29
Impacts of alternative sources.....	30
V. Mining interests and economics.....	31
U.S. mining interests.....	31
The Howard Hughes enigma.....	32
International consortia.....	35
Foreign interests.....	37
Problems in determining the economic impact of nodule mining.....	38
Establishing an international authority.....	38
Size of operation.....	38
Metal production per ton of nodules.....	39
Timing of nodule operations.....	40
Economic impact of nodule mining.....	41
Nickel.....	48
Copper.....	50
Manganese.....	51
Cobalt.....	53
Long-term economic prospects of nodule mining.....	55

	Page
VI. Government activities.....	57
United States.....	57
Foreign government activities.....	57
Australia.....	57
Federal Republic of Germany.....	57
France.....	58
Japan.....	58
New Zealand.....	58
Union of Soviet Socialist Republics.....	59
United Kingdom.....	59
Canada.....	59
VII. Legislative history.....	61
Confronting the issues.....	61
Legislative concern in the 90th Congress.....	61
Legislative concern in the 91st Congress.....	62
Legislative concern in the 92d Congress.....	65
Legislative concern in the 93d Congress.....	71
The first session.....	71
The second session.....	79
Legislative concern in the 94th Congress.....	84
VIII. International considerations.....	89
Possible cartel action.....	89
United Nations activities and relations.....	92
Nodule surveys.....	92
First and second Law of the Sea Conferences.....	92
U.N. relations and the third Law of the Sea Conference.....	94
Possible treaty implications.....	101

APPENDIXES

A. Letter from Charles N. Brower of the State Department to Senator Henry M. Jackson.....	105
B. Letter from Representative Thomas N. Downing and Senator Lee Metcalf to Secretary of Commerce Frederick B. Dent.....	111
C. Letter from Secretary Frederick B. Dent to Senate Lee Metcalf.....	115
D. S. 713.....	119
E. Deepsea Ventures, Inc.: Notice of discovery and claim of exclusive mining rights, and request for diplomatic protection and protection of investment.....	147
F. U.S. Department of State: Statement on claim of exclusive mining rights by Deepsea Ventures, Inc.....	161

LIST OF FIGURES

1. Nodules recovered during trial mining operations in the Atlantic Ocean in 1970.....	4
2. Nodule frequency versus depth in sediment.....	9
3. Nodule deposits in the North Pacific.....	10
4. Nodule deposits in the South Pacific.....	10
5. Nodule deposits in the North Atlantic.....	11
6. Nodule deposits in the South Atlantic and Western Indian Oceans.....	11
7. Offshore exploration of nodules.....	14
8. Three systems proposed for mining nodules.....	16
9. Research Vessel <i>Deepsea Miner</i>	17
10. Continuous Line Bucket System for deep ocean nodule mining.....	19
11. Hydrochloric acid process.....	22
12. Ammonia leach process.....	23
13. Sulfuric acid process.....	24
14. Figure from patent issued to Global Marine, Inc.....	34
15. U.S. demand for minerals supplied by imports in 1974.....	50

LIST OF TABLES

1. Projected U.S. consumption and percent of imports satisfied by nodule mining operations by 1985 and 2000-----	Page xvi
2. Element analyses of Pacific manganese nodules-----	5
3. Average analyses of manganese nodules-----	12
4. Comparison of 3 and 4 metal production from nodules-----	21
5. Estimated metal production per million tons of high grade nodules-----	39
6. Estimated 1985 recovery of metals by U.S. deep-ocean mining enterprises, and value at 1973 prices-----	40
7. Manganese nodules: commercially attractive constituents projections for future demand-----	42
8. Projected market value of U.S. production of metals from manganese nodules in 1985 and 2000-----	43
9. Probable metals production from nodules and estimated net import requirements of industrial countries in 1985-----	44
10. Approximate 1971 value of mineral production-----	45
11. Approximate value of mineral production, Group of 77 versus other countries -----	45
12. Participation in nodule mining consortia by U.S. firms and estimated nodule recovery by 1985-----	46
13. Projected U.S. consumption and percent of imports satisfied by nodule mining operations in 1985 and 2000-----	47
14. Nickel: World mine production and reserves-----	49
15. Copper: World mine production and reserves-----	51
16. Manganese: Stockpile status November 30, 1975-----	52
17. Manganese: World mine production and reserves-----	53
18. Cobalt: World mine production and reserves-----	54
19. Reserves of metals in manganese nodules of the Pacific Ocean-----	56
20. Changing import requirements of the United States-----	79
21. Functions of the Ocean Mining Administration-----	85

SUMMARY

Ferromanganese nodules¹ are potato-shaped concretions found on the floor of the ocean throughout many parts of the world. In some areas, the ocean floor is literally paved with nodules. The Pacific Ocean alone is estimated to contain 1.5 trillion tons of nodules which are forming at the rate of about 10 million tons per year. There are about 25 factors involved in the process to determine the economic value of a potentially mineable deposit of manganese nodules. Of these factors, the grade of the nodules, particularly their copper, nickel, manganese, and cobalt content, is the most important. The deposits of the Pacific Ocean, found in an east-west belt 200 kilometers wide south of Hawaii, in water deeper than 4,000 meters, hold the greatest economic promise at the present time.

Technology for mining and processing ferromanganese nodules is complex, and several methods are being developed. Three basic nodule recovery systems are under investigation: (1) mechanical, cable-bucket systems, (2) air-lift pumping, and (3) hydraulic lift without air. Processing ferromanganese nodules is much more difficult than processing oxide or sulfide land ores. Most of the methods being developed involve complex roasting and leaching techniques.

The impact of nodule mining on the deep ocean environment has been a concern expressed by many individuals. Research is underway to assess the extent of this impact on the biota of the deep ocean and on the quality of the surface water. Chemical and biological observations have been carried out using prototype mining systems. Results to date indicate that the environmental impact of deep ocean mining is negligible, far less than natural disturbances such as turbidity currents.

Exploration for, and development of technology for recovering, manganese nodules from the deep seabed have been underway for more than a decade. Several countries including the United States, Great Britain, France, West Germany, Japan, Canada, and the Soviet Union have interests in deepsea mining. U.S. firms have lead positions in this field but are hesitant to proceed to commercial exploitation without some guarantee of security for their projected large investments of \$300 to \$500 million for each mine site. Since 1971, bills have been introduced in Congress to provide some form of investment guarantee and regulation of mining activities. Initially, these bills represented solely the views of the American Mining Congress and were sponsored in the House and Senate for discussion purposes. No action was recommended by the Administration for fear of prejudicing the outcome of discussions in the United Nations with regard to a future conference on the Law of the Sea. As progress in the United Nations appeared minimal, and U.S. congressional hearings brought out other considerations, the deep seabed mining legislation was redrafted to provide necessary regulation and investment security, while allowing the Third U.N. Law

¹ The terms "ferromanganese nodules," "manganese nodules" and "iron-manganese nodules" are used interchangeably.

of the Sea Conference adequate time to produce a seabed treaty before commercial exploitation by U.S. nationals would be permitted.

In the meantime, most U.S. firms interested in seabed mining have joined international consortia as a means of gaining investment security, risk sharing, and pooling financial resources. They argue that in the absence of international law restricting deep seabed exploitation, they have the right to mine nodules in international waters. The Department of State supports this view. Obviously, the more countries or parties jointly engaged in such activities, the less likelihood there would be of claim-jumping or other conflicts.

The United States is heavily dependent on the metals contained in manganese nodules, primarily nickel, copper, manganese, and cobalt. There is no domestic mine production of manganese and cobalt, and domestic nickel production supplies less than 10 percent of our needs. In addition, nickel and copper are not currently stockpiled by the government. While the United States is a major copper producer, in 1974 nearly 20 percent of the copper consumed in the United States was imported. The reliability of foreign sources and the possibility of cartel action are subjects of grave concern. In this regard, the possibility that a vast resource of these metals could become available to the United States through the operations of U.S. nationals while at the same time respecting the rights of all nations to the "common heritage of mankind" is a matter that bears serious legislative consideration.

The majority of nations represented at the Third U.N. Law of the Sea Conference are from developing countries whose interests are markedly dissimilar to those of the United States and other technologically advanced countries. This has been amply demonstrated in the negotiations of the former Seabed Committee (now Committee I of the Conference) by the position taken by the developing countries and by their formation of a common negotiating bloc called the Group of 77 (now 106 countries). This group, representing approximately two thirds of the voting delegates, generally favors a form of strong international control of seabed exploitation that is unacceptable to the United States. The Seabed Authority envisioned by the Group of 77 would be effectively controlled by the developing countries (one country, one vote), and would exercise arbitrary power over seabed development. This would be accomplished by permitting mining only by the Authority or, initially, through contract arrangements under which the Authority would maintain direct and complete control of all mining operations.

The U.S. position at the Third U.N. Law of the Sea Conference favors a seabed mining authority that would permit qualified countries and private entities on a nondiscriminatory basis to mine areas of the seabed. The whole system for granting rights would be structured in the treaty to be economically efficient and to attract and guarantee security of investment. Faced with the prospects of little substantive progress toward attaining an acceptable treaty, the Administration has recently begun drafting legislation to regulate domestic firms who engage in deep seabed mining. This legislation would also

delay commercial exploitation to allow the U.N. Law of the Sea Conference additional time to reach an agreement. In further anticipation of deep ocean mining by U.S. citizens, an Ocean Mining Administration has been established in the Department of the Interior and an Office of Marine Minerals in the Department of Commerce. It is anticipated that commercial mining of the deep seabed for manganese nodules will probably begin by 1980, and that U.S. firms will be involved.

Based on recent information regarding participation by U.S. firms and U.S. subsidiaries of foreign interests in international consortia, projections can be made of the benefit to the United States from nodule mining operations by 1985 and 2000. The total annual tonnage of nodules likely to be processed and marketed by U.S. interests by 1985 could range from 4.5 to 6 million tons. This projection assumes that present difficulties regarding the entry of U.S. firms into commercial operations are resolved within the next year. This estimated recovery is based on only those firms which have announced plans for commercial operations and does not include members of the CLB Group² which was formed for exploration and systems development only.

Using the estimated nodule recovery of 5 million tons and extensions of U.S. Bureau of Mines projections of annual increases in domestic demand for the metals contained in nodules, the percent of imports and percent of U.S. consumption satisfied by U.S. controlled nodule mining operations by 1985 can be estimated (Table 1). Imports of manganese ore and ferromanganese would not likely be reduced by nodule mining by more than a few percent (the amount of U.S. consumption of high purity forms of manganese) unless manganese from nodules can in the future be marketed at a price competitive with high carbon ferromanganese. By 1985 the United States could satisfy 95 percent of the projected domestic demand for low and medium carbon ferromanganese and silicomanganese, and reduce imports of nickel approximately 24 percent, reduce copper imports 8.5 percent and be essentially self sufficient in cobalt. By 2000 nickel imports could be reduced by 31 percent (or further with substitution by cobalt) and copper imports by 10.4 percent. These projections assume that the present levels of imports to demand would otherwise be maintained which may be somewhat questionable, especially in the case of copper where the import ratio would likely increase. On the other hand, if other U.S. firms enter into commercial scale nodule mining operations, imports could be reduced still further.

Based on 1975 prices, the above projection of nodule mining could supply the United States with approximately \$0.8 billion per year in metals by the year 2000. Nodule mining by other countries or foreign shares in consortia could likely total three to five times this amount per year by then.

² In this study, CLB Group refers only to the consortium organized by Dr. John L. Mero of Ocean Resources Inc. Many members of this group are now participants in the consortium recently formed by International Nickel Co. (INCO) which has announced intentions to proceed to commercial operations if deemed feasible. Some confusion may arise as the INCO consortium has also been referred to as the CLB Group (*Oceanography Newsletter*, Apr. 21, 1975).

TABLE 1.—PROJECTED U.S. CONSUMPTION AND PERCENT OF IMPORTS SATISFIED BY NODULE MINING OPERATIONS IN 1985 AND 2000

	Estimated percent annual increase in U.S. consumption ¹	Projected U.S. consumption (short tons ²)		Estimated recovery from nodules by U.S. interests ³ (short tons)		Percent of U.S. consumption from nodules		Percent reduction of U.S. imports from nodules	
		1985	2000	1985	2000	1985	2000	1985	2000
Metal									
Selected manganese materials ⁴									
Nickel	2.0	420,000	560,000	400,000	500,000	95.0	90.0	95.0	90.0
Copper	3.0	340,000	530,000	60,000	120,000	18.0	23.0	24.0	31.0
Cobalt	3.5	3,400,000	5,600,000	52,000	105,000	1.5	1.9	8.5	10.4
	3.0	13,000	23,000	12,000	24,000	92.0	100.0	94.0	100.0

¹ U.S. Bureau of Mines, Commodity Data Summaries 1976, pp. 43, 47, 99, 113.² 1 short ton equals 2,000 lbs.³ Assumes recovery of 5,000,000 tons (dry weight) of nodules per year by 1985 and 10,000,000 tons per year by 2000. For manganese materials, assumes recovery from 1,600,000 tons per year in 1985 and 2,000,000 tons per year by 2000.⁴ Manganese materials considered here include silicomanganese plus low- and medium-carbon ferromanganese.

I. INTRODUCTION

Manganese nodules were first discovered by the *Challenger* expedition (1873-76) and have engaged the interest of oceanographers ever since. With the recent advent of technology capable of extracting minerals from the deep ocean floor, commercial interest is further heightened by growing world-wide demand for metals concentrated in manganese nodules. Increasing dependence on foreign mineral suppliers and the resulting balance of payments deficits are causing concern in the United States. In view of the increasing accessibility to exploitation of these unclaimed seabed riches and international concern for the rights and claims of all nations to a share of the world's resources, national policies and international conventions for regulating or controlling the deep seabed resources are being developed. This background report on manganese nodules, the technology for recovering them, mining interests currently involved, legislative concerns, and international negotiations in this area has been prepared as a reference tool for further congressional activity in directing a national policy for deep seabed mining.

(1)

II. COMPOSITION, FORMATION, AND DISTRIBUTION OF MANGANESE NODULES

Ferromanganese nodules are concretions that occur on the ocean floor generally in water deeper than 2,000 meters. There are two dominant types of ferromanganese deposits: (1) thick slabs or crusts which frequently develop on submarine elevations where current activity prevents normal sediment accumulation and provides a continuous supply of metals, and (2) nodules which form at great depth around nuclei of rock, plant, or animal remains. The encrustations do not appear to be economically significant whereas some nodule deposits are potentially profitable to mine. Nodules are the most common form of seabed iron-manganese concretions.

Ferromanganese nodules vary widely in shape, composition, surface texture, and internal structure. In individual localities the nodules are generally similar, but significant variations commonly occur from one locality to another. Variations may even be found over the distance of a few hundred yards. Knowledge of variations in the composition of the nodules is of importance to mining interests as most processing techniques are tailored to a fairly specific and uniform ore supply. Furthermore, some hydraulic mining techniques are designed to recover nodules within only a limited size range.

SHAPE

Nodules look like little black potatoes ranging in size from 1 to 15 centimeters (cm) in diameter and average about 5 cm across. The gross shape of large nodules appears to be controlled by asymmetric growth rather than by the shape of the core or nucleus.



FIGURE 1.—Nodules on the conveyor belt after discharge from nodule/water separator during trial mining operations in the Atlantic Ocean in 1970.

Courtesy : Deepsea Ventures, Inc.

SURFACE TEXTURE

Ferromanganese nodules exhibit several types of surface texture: smooth with black lustrous patches, sandpaper-like or gritty, "goose bumps" or numerous small welts, and knobby.¹ Generally two textures such as smooth and gritty are found on the same nodule. Many nodules have old fractures partly healed with additional manganese material and clay.

STRUCTURE

Variations in structure of the nodules are common; however, most appear to be layered in the form of concentric rings around a small nucleus. Each layer represents a compositional or mineralogical unit ranging in thickness from rings visible with the naked eye down to microscopic structures. The original surface of the layers was honey-combed, but the pores were subsequently filled with clay and the materials reorganized as the nodule grew by adding new layers. Some nodules or portions of nodules are nearly non-crystalline and, con-

¹ Raab, W. Physical and chemical features of Pacific deep sea manganese nodules and their implications to the genesis of nodules. In *Ferromanganese deposits on the ocean floor*, Horn, D. R., ed., IDOE National Science Foundation, Washington, D.C., 1972, p. 31-49.

sequently, give no X-ray pattern. X-ray patterns that are obtained indicate crystalline sizes less than a few micrometers.

Due to the fine grain size of the iron and manganese oxides and the manner in which the nodules are formed, the porosity is high and the surface area is large. The high porosity allows the nodules to take up appreciable quantities of seawater and its contained salts. Due to their large active surface area, nodules have been reported to be effective converters of unburned hydrocarbons to carbon dioxide in automobile exhausts and efficient absorbers of sulfur from stack gases.²

There is no clear age pattern in the layers but nodule samples exhibit thicker layers on the bottom side. Radiometric dating of the nodules indicates very slow growth rates of 0.1 to 0.01 times the average sedimentation rate of one meter per million years in the deep regions of the ocean where manganese nodules are most commonly found.

COMPOSITION

The composition of manganese nodules can be described in two ways: the elemental composition and the mineralogy.

ELEMENTAL COMPOSITION

Chemical analyses of nodules from several locations in the Pacific Ocean are averaged in Table 2.

TABLE 2.—PACIFIC MANGANESE NODULES—WEIGHT PERCENTAGES (DRY WEIGHT BASIS)—STATISTICS ON 54 SAMPLES

Element	Average	Maximum	Minimum
Manganese.....	24.2	50.1	8.2
Iron.....	14.0	26.6	2.4
Silicon.....	9.4	20.1	1.3
Aluminum.....	2.9	6.9	.8
Sodium.....	2.6	4.7	1.5
Calcium.....	1.9	4.4	.8
Magnesium.....	1.7	2.4	1.0
Nickel.....	.99	2.0	.16
Potassium.....	.8	3.1	.3
Titanium.....	.67	1.7	.11
Copper.....	.53	1.6	.028
Cobalt.....	.35	2.3	.014
Barium.....	.18	.64	.08
Lead.....	.09	.36	.02
Strontium.....	.081	.16	.024
Zirconium.....	.063	.12	.009
Vanadium.....	.054	.11	.021
Molybdenum.....	.052	.15	.01
Zinc.....	.047	.08	.04
Boron.....	.029	.06	.007
Yttrium.....	.016	.045	.033
Lanthanum.....	.016	.024	.009
Ytterbium.....	.0031	.0066	.0013
Chromium.....	.001	.007	.001
Gallium.....	.001	.003	.0002
Scandium.....	.001	.003	.001
Silver.....	.0003	.0006	

Note: In addition to the elements given above, cadmium, tin, arsenic, and bismuth are also found in manganese nodules.

Source: Cardwell, P. H. Extractive metallurgy of ocean nodules. Mining Congress Journal, November 1973, p. 38.

² Mero, J. L. Effects of mining sea floor nodules may be drastic for industry, society. *The Northern Miner*, Apr. 20, 1972, pp. 4-5.

Nodules commonly contain more than 30 elements. In addition to the elements included in Table 2, there are also appreciable amounts of cadmium, tin, arsenic, and bismuth.

MINERALOGY

Petrographic examination of thin sections of nodules reveals extremely fine-grained manganese and iron oxides. The two major manganese minerals that have been identified are todorokite and birnessite. Todorokite is variable in its chemical composition and can contain significant amounts of other elements, while birnessite is more highly oxidized and is most abundant in more oxidizing environments such as shallower water areas.

The only iron mineral which has been recognized in ferromanganese nodules is goethite, FeOOH . Most of the other metals found in nodules appear to be taken up by the iron and manganese oxides either by substitution, absorption, or adsorption and do not form separate minerals.

In addition to the minerals formed in place, there are considerable amounts of detrital minerals within the nodules. These include quartz, feldspars, rutile, calcite, montmorillonite, illite, and barite. These minerals are also extremely fine-grained and usually are distributed throughout the entire nodule.

FORMATION OF MANGANESE NODULES

Several hypotheses on the formation of deep seabed manganese nodules have been presented, proposing organic or inorganic processes, or a combination of both.

BIOLOGICAL ORIGINS

Recent evidence seems to favor a major role by living organisms in the creation of manganese nodules.³ Small tubular structures have been found on the surface of carefully collected nodules. These fragile structures are built from microglobules of manganese by foraminifera and other bottom-dwelling organisms. Some tubes originally constructed on nodule surfaces are found buried or preserved within the interior of nodules. The interior tube-remains are filled with clay or other debris and with manganese precipitated by inorganic or bacterial processes. In a sense, nodules may grow in much the same way as coral.

Other evidence has been found which indicates that manganese oxides can precipitate and accumulate onto a growing nodule without bacteria, but that bacterial enzymes accelerate the process through a catalytic role.⁴ Iron oxides and copper, nickel, and other metals probably precipitate inorganically, since they are known to adsorb strongly on manganese oxide. Manganese oxidizing bacteria have been found to promote the growth of nodules by manganese accretion, whereas

³ Greenslate, J. Microorganisms Participate in the Construction of Manganese Nodules. *Nature* v. 249. 1974 : 181-183.

⁴ Ehrlich, H. L. The role of microbes in manganese nodule genesis and degradation. In *Ferromanganese Deposits on the Ocean Floor*, Horn, D. R., ed., IDOE National Science Foundation, Washington, D.C., 1972 : 63-70.

manganese-oxide-reducing bacteria cause dissolution of manganese, copper, cobalt, and nickel, but not iron from the nodules.

INORGANIC ORIGINS

Earlier hypotheses favored inorganic formation of ferromanganese nodules. A recent genetic classification of ferromanganese deposits reviews these early theories and describes four types of deposits: (1) Hydrogenous deposits which are formed by slow precipitation of iron and manganese from "normal" sea water; (2) hydrothermal deposits in which the elements are supplied by hydrothermal activity on the sea floor, in areas of high heat flow frequently associated with volcanism; (3) halmyrolytic deposits in which the elements are, at least in part, supplied by submarine weathering (halmyrolysis), generally of basaltic material; (4) diagenetic deposits in which the elements are supplied partly by their postdepositional redistribution within the sediment column.⁵

Another hypothesis of inorganic formation of manganese nodules is linked to data from the Deep Sea Drilling Project. This hypothesis proposes that hot intrusive rocks could have raised the temperature in overlying sediments thereby increasing the solubility of metals in interstitial water.⁶ This could cause leaching of metals out of sediments and outward migration of waters trapped in the sediment. When these warm interstitial waters with higher than normal trace-metal concentrations reach the more oxidizing interface with the overlying ocean water, rapid precipitation of manganese, iron, copper, and nickel would result.

The role of iron as the mechanism for manganese nodule formation is the basis of another hypothesis. Evidence has been found indicating colloidal iron oxides may deposit onto suitable nuclei in cavities under conditions of locally high acidity, followed by deposition of manganese oxides and trace metals by a catalytic process.⁷

In any event, the formation of manganese nodules is a poorly understood and complex process. It is likely that no single hypothesis fully expresses all the mechanisms involved, but portions or combinations of several of the hypotheses mentioned may be valid. Present evidence seems to indicate that the nodules can be formed in a variety of ways depending on local conditions.

GEOGRAPHICAL DISTRIBUTION

Manganese nodules are found on the ocean floor in many areas of the world. Some world-wide oceanographic expeditions have recovered them at nearly every station. Although only about 3 percent of the ocean's floor has been extensively surveyed, there is abundant evidence indicating that deposits of manganese nodules exist in potentially commercial quantities. The advent of bottom photography and deep

⁵ Bonatti, E., T. Kraemer, and H. Rydell. Classification and genesis of submarine iron-manganese deposits. In *Ferromanganese Deposits on the Ocean Floor*. Horn, D. R. ed., IDOE, National Science Foundation, Washington, D.C., 1972: 149-166.

⁶ Raab, *op. cit.*, p. 46.

⁷ Burns, R. G., and B. A. Brown. Nucleation and mineralogical controls on the composition of manganese nodules. *Ferromanganese Deposits on the Ocean Floor*, Horn, D. R., ed., IDOE, National Science Foundation, Washington, D.C., 1972: 51-61.

water television has greatly increased the discovery of manganese nodule deposits. As more deposits have been found, more information has become available concerning the nature of the ocean floor where high concentrations are most likely to be found. In general, the nodules are found predominantly in areas of oxygen-rich water and low sedimentation. Areas of low sedimentation are generally in deep regions of the ocean, farthest from land and volcanic or high biological activity. Manganese nodules have also been discovered in Lake Michigan.⁸

Since nodules are found mainly on the sediment surface, or partially buried, and form much more slowly than sediment accumulates, there is some uncertainty as to what prevents their burial. Some investigators suggest that deep sea predators feed on microorganisms living on the nodules and nudge the nodules, keeping them on the surface. Others suggest that the microorganisms themselves keep the nodules buoyed up. The decrease of nodules with depth in the sediment (Fig. 2) may be explained by dissolution of the metal oxides after burial due to the different geochemical environment of the subseafloor.

⁸ Rossman, R., and E. Callander. Manganese nodules in Lake Michigan. *Science*, v. 162, 1968, pp. 1123-1124.



FIGURE 2

When nodule frequency at the surface is compared with nodule frequency at depth in the sediment column, it is clear that most nodules occur at the sediment-water interface. For example, there are four times as many nodules at the surface as in the next 3 feet of underlying sediment in the North Pacific.

Source: Horn, D. R., B. M. Horn, and M. N. Delach. Distribution of Ferromanganese Deposits in the World Ocean. In *Ferromanganese Deposits on the Ocean Floor*, Horn, D. R., ed., IDOE, National Science Foundation, Washington, D.C., 1972, p. 15.

Although manganese nodules are common on the ocean floor, deposits of sufficiently high abundance and metallic content to be commercially attractive occur in relatively few known places. Commercial interests have collected and analyzed a great number of manganese nodules, but all publicly known information is based on approximately 600 samples.^{9 10 11} They are found mainly in the Pacific, Atlantic, and Indian Oceans.

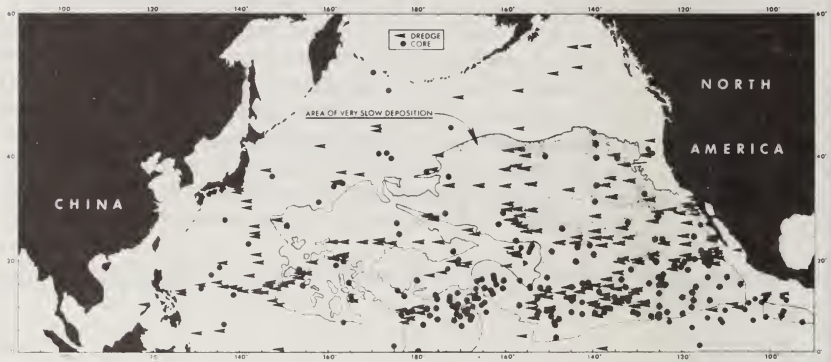


FIGURE 3

Ferromanganese deposits of the North Pacific are widespread. Limits are a function of increasing rates of deposition toward land and, in the south, by rapid accumulation of biogenic carbonate. The highest density of nodules lies between 6° 30' N and 20° N



FIGURE 4

Most ferromanganese deposits are concentrated along the line of topographic highs which includes the Manihiki Plateau; Line, Cook and Society Islands; and the Tuamotu Archipelago.

Source, Figs. 3 and 4: Horn *et al.*, 1972, *op. cit.*, p. 13.

⁹ Horn, D. R., M. N. Delach, and B. M. Horn. Metal content of ferromanganese deposits of the oceans. IDOE Technical Report No. 3, NSF-GX 33616, National Science Foundation, Washington, D.C., 1973.

¹⁰ Horn, D. R., B. M. Horn, and M. N. Delach. Ocean manganese deposits, metal values and mining sites. IDOE Technical Report No. 4, NSF-GX 33616, National Science Foundation, Washington, D.C., 1973.

¹¹ Frazier, J. Z., and G. Arrhenius. World-wide distribution of ferromanganese nodules and element concentration in selected Pacific Ocean nodules. IDOE Technical Report No. 2, NSF-GX 34659, National Science Foundation, Washington, D.C., 1972.



FIGURE 5
Ferromanganese deposits of the North Atlantic. Both the Blake Plateau and Red Clay Provinces are sites of non-deposition or very low sediment accumulation. Cores and dredges from areas outside these provinces which recovered ferromanganese are from the flanks and summits of topographic highs.



FIGURE 6
Distribution of ferromanganese deposits in the South Atlantic and Western Indian Oceans. The South American Province, and Cape, Madagascar and Crozet Basins are areas protected from continental and biogenic debris. Rates of sedimentation are low and nodules are abundant.

Source, Figs. 5 and 6: Horn *et al.*, 1972, *op. cit.*, p. 11.

NORTH PACIFIC OCEAN

The richest deposits of manganese nodules are found in the North Pacific Ocean in a narrow band south of Hawaii just north of the equatorial zone of high biological productivity (Fig. 3). This band is about 200 km wide by 1500 km long and runs roughly east-west between latitudes 6° N and 20° N and between longitudes 110° W and 180° W. The ocean floor is 4000 to 5000 m deep in this area and the sediments are rich in siliceous remains of plankton (radiolaria). The floor of the North Pacific where nodules occur can be divided into two types: siliceous ooze and red clay. The average metal values of nodules from the siliceous deposits are nickel (Ni) 1.28 percent, copper (Cu) 1.16

percent, manganese (Mn) 24.6 percent and cobalt (Co) 0.23 percent, while the nodules from the red clays contain Ni 0.76 percent, Cu 0.49 percent, Mn 18.2 percent and Co 0.25 percent.

TABLE 3.—AVERAGE ANALYSES OF MANGANESE NODULES
[In percent of dry weight]

Region	Nickel	Copper	Manganese	Cobalt
North Pacific siliceous ooze.....	1.28	1.16	24.6	0.23
North Pacific red clay.....	.76	.49	18.2	.25
South Pacific elevations.....	.41	.13	14.6	.78
South Pacific abyssal plain.....	.51	.23	15.1	.34
North Atlantic.....	.38	.15	14.2	.34
South Atlantic.....	.48	.15	18.0	.31
Indian Ocean.....	.50	.19	14.7	.28

Source: United Nations. Economic significance, in terms of seabed mineral resources, of the various limits proposed for national jurisdiction. Committee on the peaceful uses of the seabed and the ocean floor beyond the limits of national jurisdiction, A/AC.138/87, June 1973: 39 pages plus appendixes.

SOUTH PACIFIC OCEAN

In the South Pacific many manganese nodule deposits are concentrated along the southern edge of the equatorial belt and on or close to submarine elevations such as the Manihiki Plateau, Tuamotu Archipelago, Cook Islands, and Society Islands (Fig. 4). Although not as extensive as those in the North Pacific, there are several mine grade nodule deposits in the South Pacific and some have high cobalt content up to 2.3 percent. Average metal values for the South Pacific are given in Table 3.

NORTH ATLANTIC OCEAN

In the North Atlantic nodules appear to be concentrated on the Blake Plateau (in water depths of about 1000 m) and in the red clay area 1800 km east of Florida (Fig. 5). Some encrustations occur on the Mid-Atlantic Ridge. In general, the nodules have low metal content (Ni 0.18–0.32 percent, Cu 0.08–0.29 percent, Mn 13.9–14.5 percent, Co 0.35–0.42 percent) and some have high density or include substantial quantities of carbonate material unfavorable for metallurgical processing.

SOUTH ATLANTIC OCEAN

Thick crusts and nodule deposits occur in some areas of the South Atlantic. However, the deposits are generally below commercial interest in metal content. One of the more extensive areas of manganese nodules and crusts in the South Atlantic is off the west coast and southward of South Africa (Fig. 6). The deposits in this area average 0.67 percent nickel and 0.16 percent copper.

INDIAN OCEAN

Several areas of nodules and crusts are reported in the Indian Ocean, such as the Agulhas Plateau, the Madagascar Basin, and the Crozet Basin (Fig. 6). These deposits generally have metal contents below commercial interest though some potentially minable deposits are alleged by industry sources to have been discovered in the Indian Ocean.¹²

¹² United Nations A/AC. 138/87, *op. cit.*, p. 22.

III. MINING: SITE SELECTION, TECHNOLOGY AND PROCESSING

MINE SITE SELECTION

Geophysical and topographic data are necessary before a mining site can be selected (Fig. 7). The method of mining will determine, to a limited extent, the water depth and bottom conditions necessary for the mining system to work. For example, a nodule-collecting device mounted on a tracked vehicle must operate on a firmer bottom than that needed for a neutrally buoyant rake-type collection head. Both of these methods can probably operate in an area of greater topographic variation than the continuous line bucket (CLB) dredge.

About 25 factors are involved in calculations to determine the economic value of a ferromanganese nodule deposit.¹ In addition to the water depth, bottom topography, and physical characteristics of the sediment, other important criteria are the concentration of the nodules, their size, uniformity, metal content, distance to port or process facility, and weather in the deposit area. Since the nodule concentration per unit area of the sea floor and their metal content may vary within a prospective mine site, the site must be thoroughly sampled to ensure it can support a mining operation. Free-fall grab samplers, dredges, and television cameras are commonly used to evaluate the economic potential of a mining area (Fig. 7).

¹ Mero, J. L. Potential economic value of ocean-floor manganese nodule deposits. In *Ferromanganese Deposits on the Ocean Floor*, Horn, D. R., ed., IDOE, National Science Foundation, Washington, D.C., 1972: 191-203.

Offshore Exploration of Ores

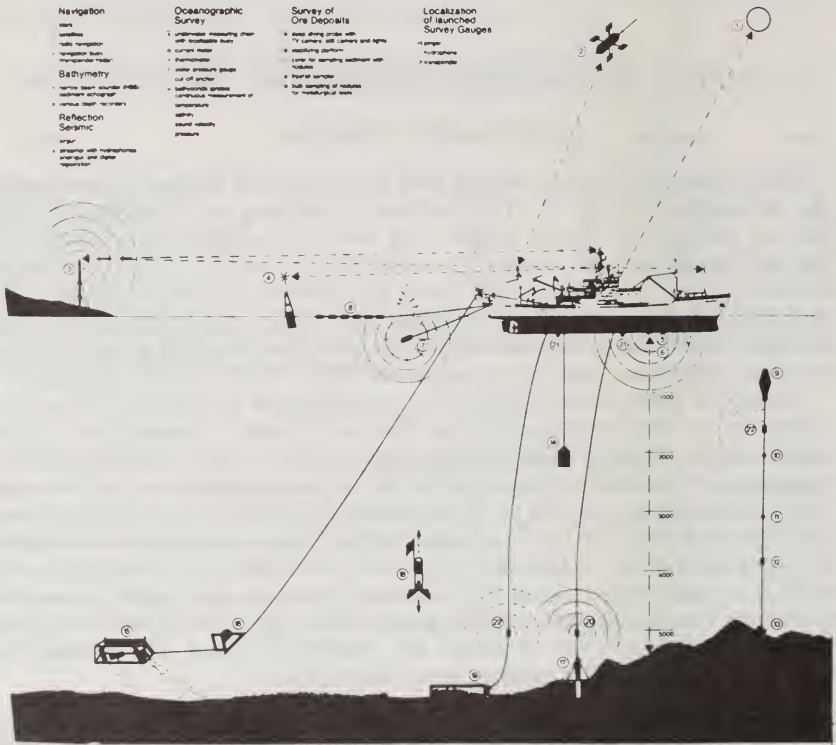


FIGURE 7.—Offshore exploration of nodules.

Source: United Nations, Economic implications of sea-bed mineral development in the international area: report of the Secretary-General, A/CONF.62/25, May 22, 1974, p. 13.

Major changes in the metals market will affect the selection of a mine site, either making lower grade nodules profitable or confining mining operations to only the highest grade deposits. The type of metals recovery process used or the metals market the company desires to enter will feed back into site selection. For example, a company may wish to market cobalt, copper, nickel, and manganese while another company may be interested in extracting and marketing only cobalt, copper, and nickel. These considerations will affect the size of the mining operation necessary, desired metal values of the nodules, and, hence, the site selection.

The efficiency of the mining system will also play a role in determining the minimum size economically feasible as a mining site. As yet there are no hard data on recovery efficiency. The total amount of ore mined from workable or accessible areas of a mine site depends on the pick-up efficiency of the collecting device and the mine sweeping efficiency or ratio of area actually swept by the bottom device to the area accessible for mining. Limited experience indicates that the dredge head pick-up efficiency is somewhere between 30 percent and 70 percent,

probably around 50 percent. The mine sweeping efficiency is a function of the characteristics of the mining equipment, navigational system, and operation procedures. Sweep efficiency may be around 45 to 65 percent. Two other factors to consider are unminable areas (about 15 to 25 percent of the bottom appears to be too rough or otherwise physically unsuitable for mining) and cut-off grade (about 10 percent of the site is expected to contain nodules of too low grade to be mined). The most unfavorable combination of factors (accessibility, dredge efficiency, sweep efficiency, and cut-off grade may allow only 9 percent of the nodules in an area to be recovered. An optimistic combination is likely to allow 35 percent recovery and a completely ideal combination could yield 58 percent recovery. A working average for nodule recovery efficiency expected by industry is around 25 percent or higher. The production period for the venture to be profitable and the overall mining efficiency determine the minimum site size. Production periods of twenty years have generally been assumed. Greater efficiency would permit a smaller mine site to be commercial as would a shorter production period, if acceptable.

Some experts believe that exploration for potential mine sites over a broad area may become more restricted or difficult if an international regime is established to regulate the seabed. However, most of the major groups involved in ferromanganese nodule mining investigations have completed the exploration stage and are aware of a number of potential mining sites.²

NODULE MINING TECHNOLOGY

Once a mining site has been selected the next problem is to collect and elevate the nodules to the surface from depths of 3000 to 5000 meters. Mining methods must be highly reliable and must recover volumes large enough to be economic. Three basic systems have been devised: (1) Air-lift, (2) hydraulic lift without air, and (3) mechanical lift such as the continuous line bucket (CLB) system. Each of these basic methods has individual variations. In addition to these continuous recovery methods, batch systems such as wireline dredging and buoyant hoppers have also been proposed.³ However, while single-collector dredging is useful for obtaining large tonnage samples for evaluation, it is not considered an economic large-scale production system due to its high cost and low recovery rate when used at great depths.⁴

AIR-LIFT PUMPING

The air-lift pumping (ALP) or pneumatic lift method is technically a three-phase flow: air, water, and nodules. Compressed air is injected into the pipe at various depths. The upward movement draws water, nodules, and surrounding sediment into the bottom end of the pipe. The nodules are literally vacuumed off the seabed and carried up

² Rothstein, A. J., and R. Kaufman. The approaching maturity of deep ocean mining—the pace quickens. *Offshore Technology Conference Preprints* 1973, v. 1, 1973, pp. 323–344.

³ Wenzel, J. C. Systems—development planning. In *Ocean Engineering*, Brahtz, J. F., ed., Wiley, New York, 1968, p. 110.

⁴ United Nations, A/CONF.62/25, *op. cit.*, p. 17.

the pipe by the flow of water and air and deposited in the mining ship on the surface (Fig. 8). The ALP system is inherently more complex than a single or dual phase system. Several technical difficulties have presented themselves. The amount and injection point of air, diameter of pipe, amount of water transported, and amount and size of solids transported each have narrow tolerance limits. For this reason, the system must be carefully adjusted to the conditions of each individual mining site.

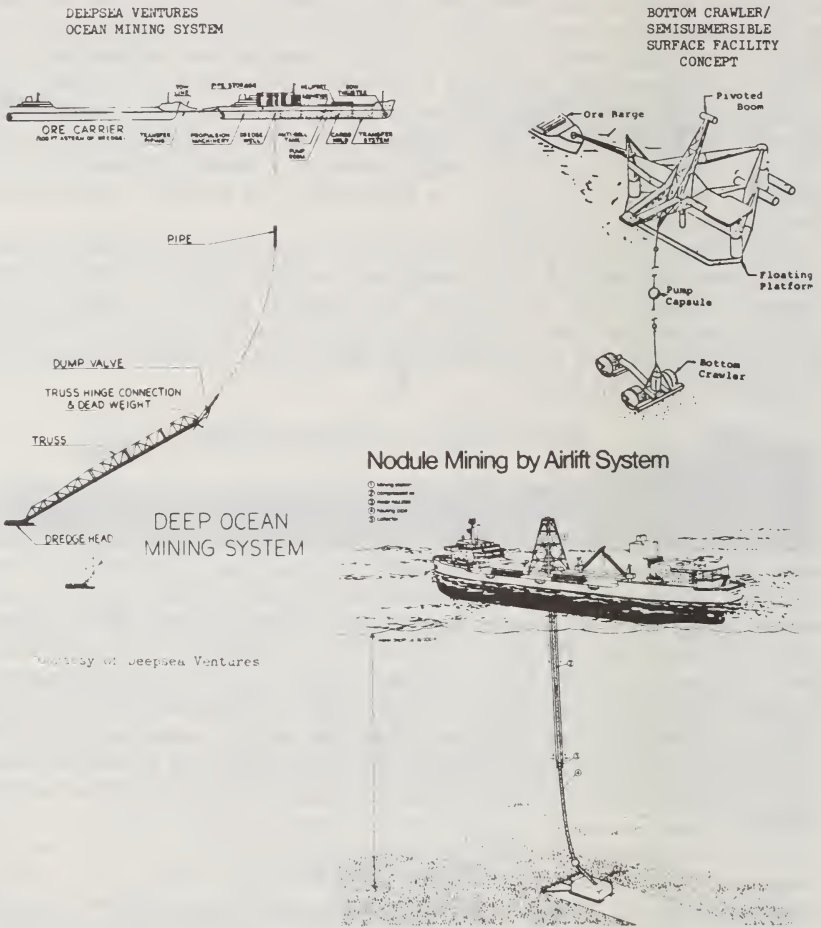


FIGURE 8.—Artist's conception of the likely operation of three systems proposed for mining nodules.

Source : United Nations, A/CONF.62/25 *op. cit.*, p. 18.

The bottom device or dredge head must be carefully designed to screen out nodules that are too large to be transported by the air/water stream or might clog the pipe. Generally, a rake type device is used to both loosen and screen the nodules. Deepsea Ventures has devel-

oped and successfully tested this system on the Blake Plateau in 750 meters of water in 1970.⁵ In the Deepsea Ventures system the dredge head is towed across the bottom by the mining ship. Modifications of this method may involve a self-propelled bottom device such as a tracked crawler or a stationary unit with a rotating arm.^{6 7}

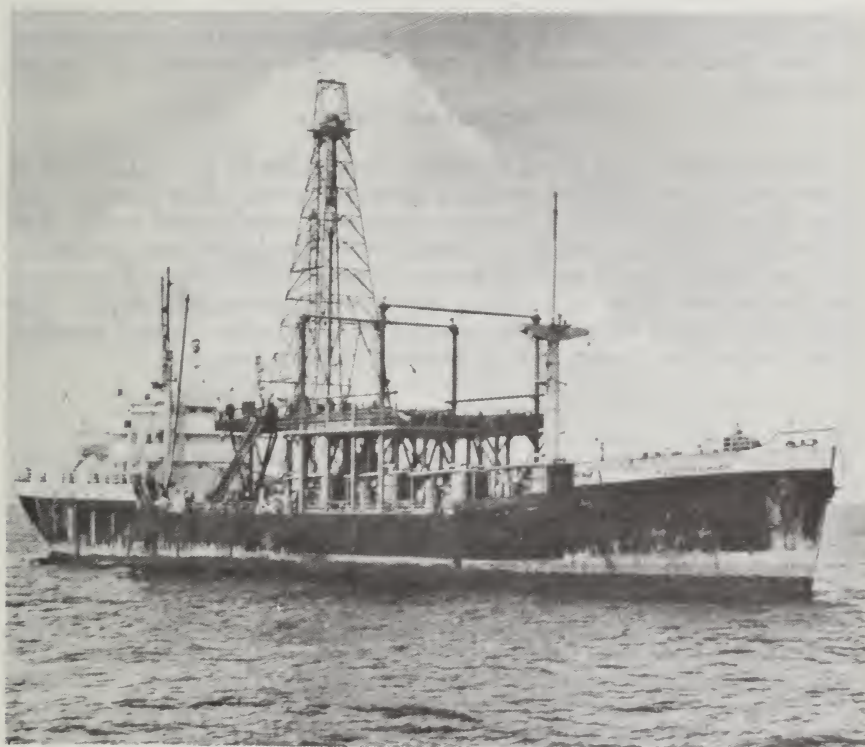


FIGURE. 9.—Research Vessel *Deepsea Miner*. A converted general cargo ship displacing 7,500 tons full load with an overall length of 320 feet. The major hull modification was the installation of a 20 foot by 30 foot long well (Moon Pool) slightly aft of midship. A 5 foot high derrick was installed to handle several thousand feet of 9 $\frac{5}{8}$ " drill casing.

Photo by B. J. Nixon, Deepsea Ventures, Inc.

The efficiency of the air-lift system is not completely known. Since nodules larger than the system can support must be rejected, the efficiency on that basis alone would be lower than total size range recovery systems. The large factors of uncertainty, however, are how efficiently the dredge head can interact with the bottom and how tight a pattern of traversing the mine site the mine ship can accomplish.

⁵ Covey, C. W. Ocean mining system completes tests. *Under Sea Technology*, October 1970, p. 22-23, 28.

⁶ Sheary, G. W., and J. E. Steele. Mechanical deep sea nodule harvester. United States Patent 3,480,326, November 1969.

⁷ Smith, W. J. An assessment of deep-sea manganese nodule exploitation technology. Unpublished manuscript, Woods Hole Oceanographic Inst., 1972.

From a resource management point of view, it would be desirable for the site to be mined as efficiently as possible to minimize the area of disturbance.

From a reliability point of view, although the ALP system must supply great amounts of compressed air to various water depths, there are no underwater pumps and other machinery to break down. However, the ALP system is more complex in concept than a CLB system which doesn't have a long pipe string to handle, and the bucket system is more flexible in the ability to cope with a variety of bottom conditions.

HYDRAULIC LIFT

The hydraulic or hydrolift system is similar to the ALP, but it relies entirely on pumped water to provide upward flow through the pipe. This is technically a two-phase system: nodules and water. The technology for this system is already well developed and is used in the coal industry and in mud pumps used in oil drilling. The pump can be located close to the bottom or at intermediate depth. The hydraulic system seems to be favored by a recently formed international consortium managed by Kennecott Copper Corp.^{8 9}

MECHANICAL LIFT

The third major recovery method, the continuous line bucket (CLB) system, appears to be the simplest in principle. This system uses a continuous polypropylene braided rope with dredge buckets attached at 25 to 50 meter intervals. The rope is wound through traction motors mounted at both forward and aft ends of the mining vessel. Because the rope line is neutrally bouyant, it tends to loop out away from the direction of motion of the mining ship (Fig. 10). As the line rotates the bottom of the loop drags across the seabed filling the buckets. The drag and increased weight of the buckets causes the loop to become more directly aligned with the lifting force. Consequently, the line moves upward more nearly vertically than its descent, and fouling of the loop upon itself is avoided.

⁸ Tinsley, C. R. In search for commercial nodules, odds look best in Miocene-age Pacific Tertiary System. *Engineering and Mining Journal*, June 1973, p. 114-116.

⁹ *Oceanography Newsletter*, v. 9, No. 3, Feb. 1974, pp. 1-2.

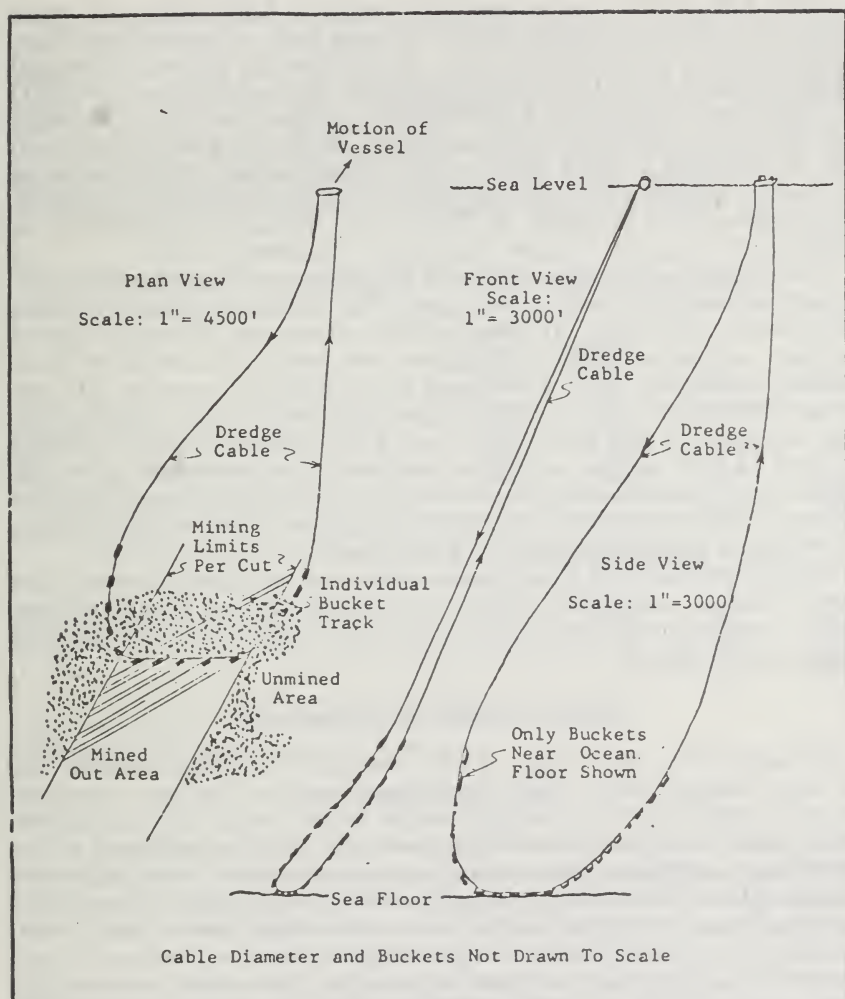


FIGURE 10.—Schematic drawing illustrating the design and operation of the Continuous Line Bucket System for mining deep ocean nodule deposits as proposed by Yoshio Masuda. A successful pilot test of this system was conducted in over 12,000 ft. (3,650 m) of water north of Tahiti in the summer of 1970. Source: Mero, *op. cit.*, p. 199.

The CLB system is the method in which there is the greatest amount of international participation. One of the largest ventures formed is a mining consortium called the CLB Group.¹⁰ The CLB Group is a joint systems development effort involving more than 25 major companies in six countries and is managed by Dr. John L. Mero, president of Ocean Resources, Inc. of La Jolla, California. This consortium only intends to develop and test jointly the CLB system, then split up for commercial operations.

¹⁰ *Oceanography Newsletter*, v. 9, No. 12, June 24, 1974, pp. 1-2.

The CLB system was successfully tested in 3,650 meters of water north of Tahiti in August 1970.¹¹ A later test in August and September 1972 recovered seven tons of nodules off Hawaii.¹² Several participants of the CLB consortium under the leadership of CNEXO of France are developing a modification of the CLB which involves the use of two ships working in tandem.¹³ Members of the CLB Group met in Houston in May 1974 to plan financing and construction of a two-ship system which is expected to be ready for testing in 1975-76. The system will be built in France by Ateliers et Chantiers de Bretagne.¹⁴

The primary advantage of the CLB system over the other two techniques is simplicity and perhaps cost. The latter advantage has been strenuously disputed.¹⁵ It also has the advantage of being able to recover nodules of any size and does not need to be designed for a specific depth and type of sediment as do hydraulic and air-lift systems. Difficulties with the CLB system may result from irregular bottom topography and potential snags. The buckets must also pick up a good load of nodules and little sediment for the system to be economic, and there is no way to control how the buckets interact with the bottom. Critics also claim the system cannot be cycled rapidly enough to recover a profitable tonnage of nodules.¹⁶

Mining efficiency of this system again can only be estimated. The area mined is controlled by maneuvering the surface mining ship or ships; consequently, bottom coverage and nodule recovery may be somewhat inefficient.

NODULE PROCESSING TECHNOLOGY

Because of the mineralogy of ferromanganese nodules is unlike that of any commercially mined land-based mineral deposit, straightforward methods of extracting metals do not work. The manganese oxide and iron oxide minerals that are the main constituents of the nodules are extremely fine-grained and are bound in a rock (siliceous) matrix. Most of the other metals of interest are present in the nodules essentially as impurities in the iron and manganese oxides. Consequently, physical methods of separating the metals have not proved successful. Although it is possible to reduce the oxides by smelting, the resultant alloy of iron and other metals is difficult to separate further. Generally, chemical leaching or hydrometallurgical techniques are considered the most likely commercial methods. Details of most of these methods are regarded as proprietary information by the companies developing them. From information available, general descriptions of some of these extraction methods or metal winning processes can be derived.

¹¹ Masuda, Y., M. J. Cruickshank, and J. L. Mero. Continuous bucketline dredging at 12,000 feet. *Offshore Technology Conference*, Preprints Paper No. 1410, 1971.

¹² *Mining Magazine*, January 1973, p. 7.

¹³ United Nations, A/CONF.62/25, *op. cit.*, p. 19.

¹⁴ CNEXO, *Bulletin d'Information*, No. 61, January 1974, p. 5.

¹⁵ Hammond, A. L., Manganese Nodules (II): Prospects for Deep Sea Mining, *Science*, v. 183, Feb. 15, 1974, pp. 644-646.

¹⁶ *Ibid.*, p. 644.

The first step in virtually all extraction techniques involves crushing the nodules. Nickel and copper are relatively easy to separate by chemical methods as these metals are associated with the manganese oxides. Leaching solutions can be developed to concentrate these metals and leave most of the others behind. Cobalt is found mostly with the iron minerals.¹⁷ Removing cobalt and other metals requires additional steps. The leaching method is carefully designed to optimize the yield of the particular metals which a company wishes to market (Table 4).

TABLE 4.—COMPARISON OF 3 AND 4 METAL PRODUCTION FROM NODULES
MANGANESE WILL BE THE MAJOR PRODUCT IF THE OCEAN IS MINED FOR 4 METALS * * *

	Annual output (millions of pounds)	Estimated price (per pound)	Gross value (millions)	Percent of gross value
Manganese ¹	500.0	\$0.15	\$75.0	58.8
Nickel.....	25.0	1.40	35.0	27.5
Copper.....	20.0	.56	11.2	8.8
Cobalt.....	4.4	1.40	6.2	4.9
Total.....			127.4	100.0
* * * BUT NICKEL WILL BE CRUCIAL TO THE COMPANY THAT PRODUCES ONLY 3 METALS				
Nickel.....	75.0	\$1.40	\$105.0	66.8
Copper.....	60.0	.56	33.6	21.4
Cobalt.....	13.2	1.40	18.5	11.8
Total.....			157.1	100.0

¹ Assumes that high-purity manganese will be marketed rather than ferromanganese.

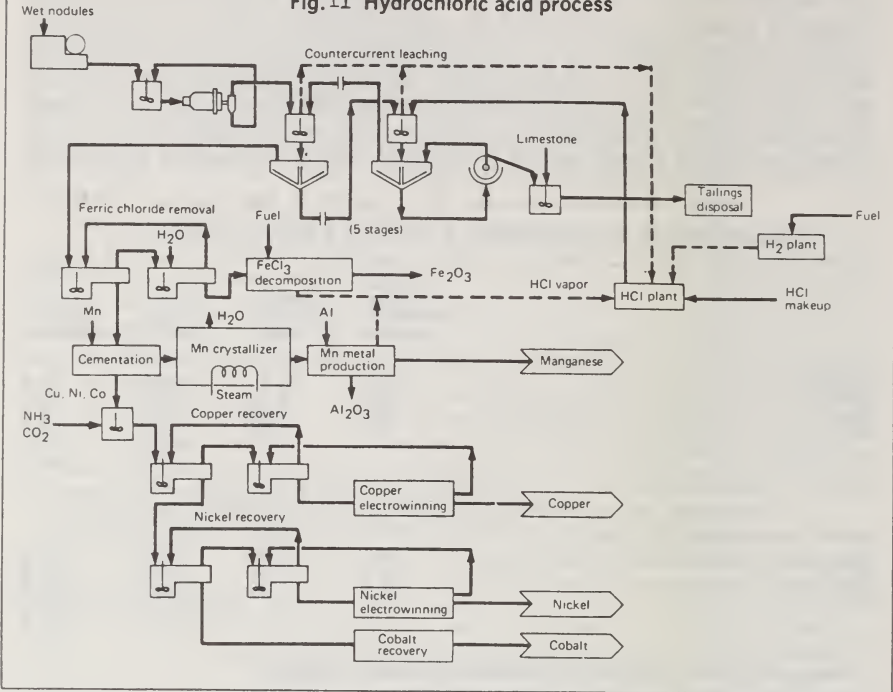
Source: *Chemical and Engineering news*. Mar. 4, 1974, p. 25.

HYDROCHLORINATION

One leaching method being developed is the hydrogen chloride process of Deepsea Ventures. In this method hydrogen chloride reacts with the crushed nodules at elevated temperatures to dissolve essentially all the nodule material. Most of the metals except iron form soluble metal chlorides which are then leached with water and separated from the solid residue. The solid residue containing inert silicates, sulfates, and oxides (mainly iron oxides) is regarded as waste. Chlorine gas is recovered as a by product and hydrogen chloride can be recovered from the leach liquor and recycled (Fig. 11).

¹⁷ *Ibid.*, p. 646.

Fig.11 Hydrochloric acid process



Source: Sisselman, R. Ocean Miners take soundings on Legal Problems, Development Alternatives, *Engineering and Mining Journal*, April 1975, p. 86. Copyright 1975, Engineering and Mining Journal, 1221 Avenue of the Americas, New York, N.Y. 10020.

A proprietary ion exchange process extracts each metal into a separate solution from which it is plated out in an electrolytic cell. Since manganese cannot be recovered electrolytically, another proprietary method is used for this metal.

The metals initially slated for recovery by this method are cobalt, copper, nickel, and manganese. Recovery of other metals such as molybdenum, vanadium, zinc, and cadmium is being considered should market conditions make their production profitable. This apparently is the only process being considered commercially that would produce high-purity manganese from the nodules.

Advantages of this method are the high recovery rate of the metal content of the ore (better than 95 percent) and the low potential for pollution problems (the solvents are recycled).

SULFUR DIOXIDE ROASTING AND WATER LEACHING

A second process, suitable for production of manganese in the form of ferromanganese, is the sulfur dioxide (SO_2) roasting method developed by the U.S. Bureau of Mines. The basis of this method is to get the ore in the form of soluble sulfates by roasting in an atmosphere of SO_2 and air, followed by leaching in water. Copper is precipitated out directly using metallic iron, while nickel and cobalt are recovered by an autoclaving technique. Further purification of the nickel and cobalt

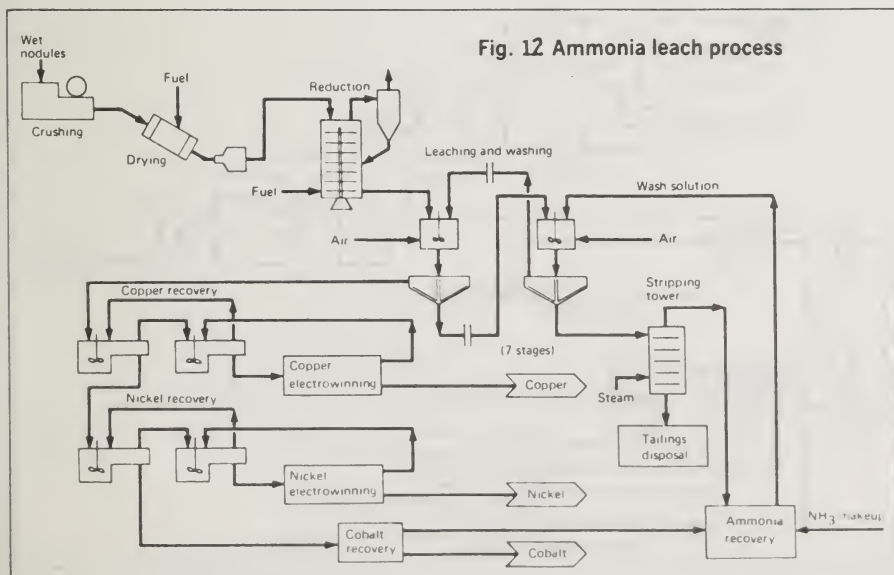
sulfates is necessary before conversion to metallic form. The remaining manganese sulfates can then be processed further to yield ferromanganese.

The entire process is rather involved and exacting, but its overall complexity may be no greater than other methods. Companies that have sulfur dioxide to dispose of (as from copper smelters) may find this method attractive.

Among the disadvantages are that the sulfate system is difficult to operate as a closed cycle and it is reported that 45 percent of the sulfur used is not recovered.¹⁸ This may present a pollution problem. However, disposal of the unrecovered sulfate ion may be easier than sulfur dioxide if the latter were a disposal problem initially as in the case of smelter gas.

AMMONIACAL LEACHING

A third process, whereby only the associated metals of nickel, copper, cobalt, and molybdenum are recovered from the nodules, involves the use of ammoniacal solutions (ammonia plus an ammonium salt such as a carbonate, chloride, or sulfate). In order to dissolve the metals using ammoniacal solutions, the oxides must first be reduced (Fig. 12). This is accomplished by roasting with a gaseous reducing agent such as carbon monoxide or hydrogen. Elevated temperatures and pressures are used to improve the metal recovery from the reduction and leaching operation. This process is reported to recover 85 percent or better of the copper, nickel, cobalt, and molybdenum leaving the manganese and iron essentially intact.¹⁹



Source: Sisselman, R. *op. cit.*, p. 84. Copyright 1975, *Engineering and Mining Journal*, 1221 Avenue of the Americas, New York, N.Y. 10020.

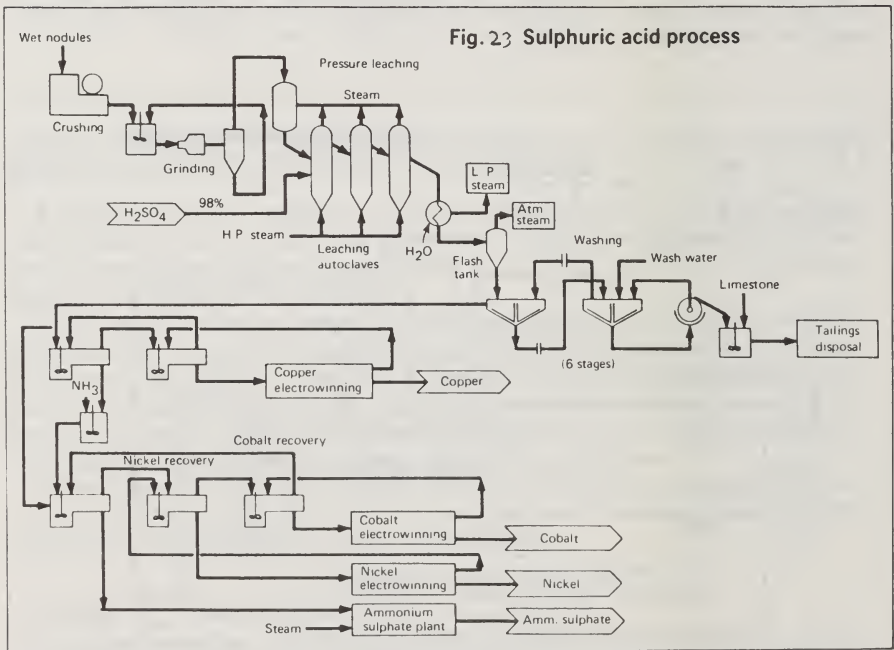
¹⁸ Brooks, P. T. and D. A. Martin, Processing manganiferous sea nodules. U.S. Bureau of Mines, Report of Investigations 7473, 1971.

¹⁹ Cardwell, *op. cit.*, p. 41.

Kennecott has obtained a number of patents for ammoniacal leaching methods. This process is similar to one used to extract nickel from laterite ores and is believed to be the process favored by Kennecott for commercial use in nodule processing.

SULFURIC ACID LEACHING

Several investigators have tried leaching ferromanganese nodules in sulfuric acid under various conditions of time, temperature, and acidity (Fig. 13). The basis of this method is that individual metals exhibit differing degrees of solubility under varying conditions of acidity. The problems mainly involve a trade-off between the efficiency of extraction and the amount of unwanted material extracted or selectivity of extraction. In general, the method is not regarded as being selective enough for commercial operations. Copper, nickel, and cobalt are readily dissolved, but appreciable amounts of manganese and iron along with several trace metals are also leached. This leads to problems in further separation. An additional disadvantage is the large amount of acid consumed, about ten times that equivalent to the dissolved metals. Presumably this is due to the large amount of basic material trapped within the nodules.²⁰ Furthermore, if a closed loop system is devised, the concentration of trace metals will build up in the leach liquor making purification of the economic metals more difficult.



Source : Sisselman, R. *op. cit.*, p. 85. Copyright 1975, *Engineering and Mining Journal*, 1221 Avenue of the Americas, New York, N.Y. 10020.

²⁰ *Ibid.* p. 41.

SMELTING

Although this method is a standard technique of land-based mining operations, it does not appear to be of commercial interest for processing ferromanganese nodules. The problem again is one of selectivity. Manganese nodules contain numerous metals which smelting reduces to a complex alloy. Still, investigations of this method for processing ferromanganese nodules have been made.²¹

In the pyrometallurgical approach, the objective is to reduce selectively and collect the nickel, copper, cobalt, and molybdenum in a metallic product while rejecting a major part of the manganese and iron in the slag. By regulating the temperature and amount of carbon introduced, it is possible to control the distribution of manganese between the molten iron phase and the slag. However, while the metallic phase is nearly free of manganese, it contains an appreciable amount of iron from which it is difficult to separate the marketable metals. The manganese slag could be processed further into a ferromanganese product. This pyrometallurgical approach may be of interest only if an existing smelter were available, but it is not likely to attract new capital.²²

²¹ *Ibid.* pp. 39–40.

²² *Ibid.* p. 40.

IV. ENVIRONMENTAL CONCERNS

As every action man undertakes has an environmental impact, the mining of ferromanganese nodules will have some effect on the environment of the ocean floor as well as on the entire water column through which the mining system passes. The need to define better the magnitude of this impact has been a concern raised by many. Research to date indicates that the environmental impact of deep seabed mining may be negligible.

PREVIOUS RESEARCH

Several investigations have been conducted to determine the extent of the environmental impact of manganese nodule mining. At the invitation of Deepsea Ventures, Inc., in the summer of 1970 a group of marine scientists under the direction of Dr. Oswald A. Roels of the Lamont-Doherty Geological Observatory observed a pilot ALP mining test on the Blake Plateau in the Atlantic. In this test, studies were made on the mixing of the bottom water discharged into the surface waters and its effect on dissolved oxygen concentration and phytoplankton growth. No significant effects were found. In July 1972, a cruise aboard the R/V *Robert D. Conrad* was undertaken to determine the physical, chemical, and biological baseline conditions in a manganese nodule province on the Bermuda Rise. The bottom dwelling fauna were found to be very sparse in this area. In August and September 1972, investigators under support from the National Oceanic and Atmospheric Administration (NOAA) monitored a test of the CLB mining system in a siliceous ooze province in the North Pacific. Physical, chemical, and biological conditions of the water column were observed and bottom dwelling fauna were sampled before, during, and after the mining operation. In addition, cores and photographs were taken of the bottom. The investigators found the effects and disturbances of the mining operation were very minor.

SPECIFIC EFFECTS

Deep sea mining may generate several specific problems such as repopulation, transplantation, surface water contamination, and pollution from shipboard processing. These problems have been investigated and although apparently minor, monitoring would be desirable during commercial operations.

REPOPULATION

The ability of bottom organisms to repopulate a mined area will affect the extent and duration of the environmental impact. No data on this have been obtained although the National Oceanic and Atmospheric Administration is actively engaged in a limited research

program to determine the environmental impact of deep sea mining.^{1 2}

In addition to damage of organisms in the mining path, bottom sediments stirred up by the mining operation may clog or smother benthic (bottom dwelling) organisms over a much wider area than that which is actually mined. This could make the reestablishment of the bottom ecosystem even more difficult. Depending on the magnitude of the sediment stirring problem, proposed unmined buffer zones for repopulation purposes may be ineffective unless made very wide. However, it is not likely that entire species will be destroyed by mining operations as the present techniques are not 100 percent efficient in bottom coverage.

TRANSPLANTATION

Another possible consequence of the suspension of lifted sediments in the water column is the transplantation of spores or other dormant forms of microorganisms from one area, where they lay in the sediment, to another, where they may be reactivated under favorable temperature, light, and oxygen conditions in the overlying water column. However, it has also been argued that the redistribution of sediments on the ocean floor from natural causes exceeds by several orders of magnitude any disturbance ever likely to be caused by deep sea mining.³

SURFACE WATER CONTAMINATION

The introduction of bottom water and material into the upper water layers is a complex problem and may prove either beneficial or deleterious. Introduction of sediments and bottom material into the surface waters may increase trace-metal concentrations by leaching of nodules or sediments, which could inhibit photosynthesis or allow the accumulation of different trace metals within marine food chains. However, nodule material is not very likely to dissolve in the upper water layers. The oxide surfaces represent such effective adsorbents that trace metals are unlikely to be leached in large quantities, even though they are present at concentrations many times those in seawater. Some silicious material brought up as sediment could be expected to dissolve slightly increasing the silica (SiO_2) content of the surface water.

A likely effect on the surface water will be an increase in photosynthetic activity and productivity resulting from the high nutrient concentration of the bottom water. The extent of this effect will be determined by the concentration of nutrients introduced into the surface water and the amount of time that this nutrient-rich water remains in the euphotic zone. A phytoplankton bloom should be beneficial if a food chain develops to consume it, otherwise decaying plankton may cause partial fouling of the water. However, because organic particulate material will oxidize slowly as it falls through the water column, the resultant decrease in oxygen concentration probably will be very small and may not cause any significant fouling. Oxidation of organic material discharged in the mining effluent as a

¹ *Ocean Science News*, v. 16, No. 19, May 10, 1974, p. 2-3.

² U.S. Department of Commerce. The environmental impact of deep-sea mining, progress report. NOAA Technical Report ERL 290-OD 11, Boulder, Colo., 1973: 185 p.

³ U.S. Congress, Senate, Committee on Interior and Insular Affairs, Subcommittee on Minerals, Materials and Fuels. Hearings, 93d Congress, 2d session on Amendment No. 946 to S. 1134, Mar. 5, 6, and 11, 1974. Part 2, Washington, U.S. Govt. Print. Off., 1974. pp. 1091-1092.

result of the destruction of benthos (deep sea plant or animal organisms) will also reduce oxygen in the water. On the other hand, nutrient stimulated photosynthesis will increase the oxygen concentration. Perhaps a more serious effect is that discharged particulate material will produce turbidity in the euphotic zone cutting down light intensity and reducing photosynthetic activity.

POLLUTION FROM SHIPBOARD PROCESSING

Another environmental consideration would be the potential impact of the discharge of wastes or residues from possible shipboard preliminary processing of nodules. If any such methods are developed that are not self contained, wastes or residues could produce a severe strain on the ecosystem in the mining area. However, most major concerns involved in the development of manganese nodules have determined that at least for first generation plants, economical processing can be accomplished only ashore. The principal reasons for this are that the reagent transportation costs will be equal to, or greater than the nodule costs, and problems of waste disposal and environmental protection will be much greater at sea than on land.

COMMON EFFECTS

Although several different mining systems are proposed, some common effects can be expected and some impacts are unique to each system. Among the common impacts are:

- (1) the destruction of the benthic (bottom dwelling) organisms and their habitats in the path of the mining operation;
- (2) stirring up sedimentary material as the mining implement sweeps the ocean floor; and
- (3) introduction of sedimentary material, associated bottom organisms, and bottom water into various layers of the water column, including, in some cases, the surface water.

The extent of each of these impacts depends on the mining technique used. Both the air-lift pumping (ALP) and hydro-lift systems transport nodules, sediment, benthos and deep water to the surface. In these processes abrasion produces quantities of fine nodule material and macerated organic material. Except for the nodules, all these materials are discharged into the ocean surface water where they may remain in suspension or sink depending on their physical conditions. The continuous-line bucket system is designed to bring only nodules to the surface; however, in practice some benthos and sediment may be entrapped and distributed throughout the water column. This system will introduce more sediment into the lower water column but less material into the surface water than the ALP or hydro-lift systems. In addition to environmental concerns, stirred sediment is also a mining problem. It may obscure the bottom or cover the nodules making recovery difficult.

FINDINGS AND FURTHER INVESTIGATIONS

In reporting on preliminary investigations, including monitoring an ALP mining system on the Blake Plateau in the Atlantic and a CLB system in the silicious ooze province in the North Pacific, the NOAA report concluded, "In this preliminary work, no definite effects

of mining have been observed, tentatively suggesting that mining disturbances were not great."⁴ This assessment was based on numerous analyses of the physical, chemical, and biological conditions of the overlying water column before, during and after the mining operations and several cores and pictures of the sea floor. NOAA recommended further research should:

(1) establish physical, chemical, and biological baseline environmental conditions in potential mining areas;

(2) document changes induced in benthic and pelagic ecosystems by deep-sea mining;

(3) formulate guidelines for future mining operations which will minimize harmful environmental effects while enhancing the development of potentially beneficial byproducts; and

(4) determine the properties which should be monitored during deep-sea mining to provide the information needed to evaluate the environmental impact of specific mining methods and to devise mitigating measures, if necessary.⁵

In early May 1974, the National Oceanic and Atmospheric Administration of the Commerce Department announced the establishment of a Deep Ocean Mining Environmental Study (DOMES) based at the Pacific Marine Environmental Laboratory in Seattle.⁶ Under funding of \$3 million for fiscal year 1976, DOMES began a three-month environmental study in the tropical Pacific with more than 30 scientists from NOAA, the Geological Survey, and several universities aboard the NOAA ship *Oceanographer*. An advisory panel has been authorized to review DOMES activities to ensure their relevance to industry, environmental interest groups, and other government agencies. One reason given for placing immediate emphasis on environmental studies is that if commercial mining is expected to start by 1980, corporate decisions on mining equipment design and production techniques should have been in the final stages by mid-1975.⁷

In September 1975, the Office of Marine Minerals (OOMM) was established in NOAA to plan and coordinate NOAA's expanded marine mining activities. The DOMES effort and \$750,000 in Sea Grants in fiscal year 1976 were identified as programs with which the new office will be concerned. Onshore impacts from activities such as nodule processing will also be studied.

IMPACTS OF ALTERNATIVE SOURCES

By way of comparison with present ores, manganese nodules do not contain sulfur; therefore, there will be no waste disposal problems of sulfur salts, acids, or gases. However, other materials used in processing may present disposal problems depending on the metallurgical process developed.

Nodule mining could provide the entire world population for hundreds of years with a sufficient supply of many metals. To equal this reserve by land mining would require the exploitation of many new areas including mining low grade deposits which are not now commercial. It is possible that in the future these areas may need to be used or preserved for other purposes.

⁴ U.S. Department of Commerce, *op. cit.* p. 165.

⁵ *Ibid.* p. 161.

⁶ *Ocean Science News, op. cit.*, p. 2-3.

⁷ *Ibid.*, p. 3.

V. MINING INTERESTS AND ECONOMICS

Although many companies individually began exploration and development of mining systems for deep seabed ferromanganese nodules, the recent trend has been to band together into national or international consortia. The major mining interests and consortia currently involved in nodule recovery are summarized in the following categories: (1) U.S. interests, (2) international consortia, and (3) foreign interests.

U.S. MINING INTERESTS

One of the early entries into deep ocean mining was Deepsea Ventures, Inc., a subsidiary of Tenneco Inc. Deepsea Ventures was organized in 1968 by Tenneco to further an ocean mining project which had been previously under development for six years by another Tenneco subsidiary, Newport News Shipbuilding and Dry Dock Company. Deepsea Ventures has operated two mining research vessels, the 150-foot R/V *Prospector* and the 320-foot R/V *Deepsea Miner*. Their mining technique and ore processing involve an air-lift recovery system and hydrometallurgical extraction of manganese in addition to copper, cobalt, and nickel. In May 1974, Tenneco formed a consortium of Deepsea Ventures with three Japanese firms. In November 1974, the consortium was joined by United States Steel Corp. and Union Miniere of Belgium.¹ This development will be discussed in the next section under consortia. On November 14, 1974 Deepsea Ventures became the first company to file a claim for mining rights on the deep seabed. This claim is not officially recognized by the U.S. Department of State.

Another early entry into the field of seabed mining was Kennecott Copper Corp. This firm began research into nodule deposits, mining, and processing in 1962. It has developed nodule recovery techniques based on hydraulic methods and carried out research on hydrometallurgical processes of metal extraction, some involving liquid ion exchange. In 1973 Kennecott operated a pilot plant in Lexington, Massachusetts, which processed half a ton of ore per day. This process did not recover manganese or trace metals. On January 29, 1974, Kennecott announced the formation of an international consortium with firms from Japan, Great Britain, and Canada.

Among the other U.S. companies to have developed an interest in deep ocean mining are Union Carbide Exploration Corp. However, Union Carbide is reported to have dropped its nodule mining pro-

¹ *Ocean Science News*. Nov. 15, 1974, p. 4.

gram.² Founded in 1965, Ocean Resources Inc. has worked with Japanese, European, and Canadian firms to develop a CLB mining system. In 1968 and 1970 Ocean Resources conducted cruises for exploration of nodule deposits and development of a CLB system with the Japan Ocean Resources Association. In 1971 Ocean Resources organized a consortium to test a CLB system. More recently, Ocean Resources organized a 25-member consortium from six countries to develop and production-test CLB systems. Other U.S. firms represented in this consortium include Ethyl Corp., Occidental Minerals, Phelps-Dodge, N.L. Industries, Superior Oil, Utah International, United States Steel, General Crude Oil, and Atlantic Richfield Oil. Bethlehem Steel is also reported to have an interest in nodule mining.³ Battelle Memorial Institute is reported to be conducting research on nodule processing.⁴

Another U.S. firm with a generally unadvertised but long standing interest in deep seabed mining is Lockheed Missiles and Space Co., Inc. In November 1975, Lockheed publicly announced that it had been developing a nodule mining system and processing technology for over 10 years. However, Lockheed stated it cannot proceed alone to the expensive ocean testing phase.

THE HOWARD HUGHES ENIGMA

In view of recent events, a U.S. firm that bears special mention with regard to the development of deep sea mining technology is the Summa Corporation owned by the billionaire recluse Howard Hughes. In 1968, a Russian diesel-powered submarine carrying torpedos and missiles armed with nuclear warheads sank about 750 miles northwest of Hawaii. The ship broke up as it sank to the ocean floor at a depth of 16,000 feet. Evidently, the Russian navy did not know the exact location of the mishap although U.S. listening devices had pinpointed the ship's location with accuracy.⁵ The U.S. Navy and Central Intelligence Agency (CIA) recognized this as a rare opportunity to gain valuable information about Soviet codes and nuclear capabilities. However, the means of retrieving the remains of the submarine were lacking. The CIA apparently provided the incentive for Howard Hughes to build the 618-foot, 36,000-ton *Glomar Explorer*, which was widely advertised as a deep seabed mining ship, with recovery of the submarine in mind. In any event, deep seabed mining made a good cover for the secret activities of the CIA to recover the submarine. Consequently, the CIA became the owner and primary impetus for the development of the specialized deep sea recovery technology through Summa Corporation, beginning about 1970.

The normal secrecy of the Hughes operations contributed to the complete success of the cover story resulting in numerous accounts such as, "Howard Hughes may have manganese nodules on the deck of his deep-ocean mining ship, the *Glomar Explorer*, by mid-1974."⁶

² Mineral Resources of the Deep Seabed, Part 2, *op. cit.*, p. 1081.

³ *Oceanograph Newsletter*, v. 9, No. 12, June 24, 1974, p. 1.

⁴ Ellipse, J. E. Ocean Mining Stifled by lack of U.S. and U.N. Action. *Sea Technology*, January 1974, p. 33.

⁵ *Washington Post*, Mar. 23, 1975, p. A1 and A7.

⁶ Tinsley, C. R. Mining of Manganese Nodules: an Intriguing Legal Problem. *Engineering/Mining Journal*, October 1973, p. 84.

Other accounts were also speculative or else described design features of the ship or equipment that could not be concealed.^{7 8}

The cover story not only deceived the news media and mining community but also had an effect on the Law of the Sea negotiations on exploitation of deep seabed resources. It was reported that the activities of the Summa Corporation mining ships were a frequent topic in the corridors in Caracas.⁹ Others have been led to speculate, "Hopefully, the first benefit of the Hughes venture will be to catalyze action on some settlement of the question of manganese nodules and the law."¹⁰ However, now that the covert activities of Hughes are known there is a suspicious reaction to the question of all ocean research. Christopher W. Pinto of Sri Lanka observed at the Geneva session of the Law of the Sea Conference: "The developing countries have been arguing on the basis that espionage is the real reason why the major powers seek complete freedom for scientific research. Now that this is confirmed, they can be more forceful."¹¹

This all began in 1970 when the Summa Corporation contracted with Lockheed Missiles and Space Co. and Global Marine, Inc., who have extensive experience in undersea technology and deep sea drilling techniques to design a recovery system. The fact that Global Marine has a patent for a deep seabed nodule mining system filed as early as December 1966, that appears to be compatible with the ship and barge system actually constructed, would suggest that the basic technology developed for retrieval of the submarine, if not originally intended for nodule mining, could readily be transferred to nodule mining. The claw arrangement described in the press for grappling the submarine¹² could be replaced by the mining head described in patent 3,433,531 issued to Global Marine in March 1969 (Fig. 14). The apparatus described in the patent consists of a long rotating boom on a fixed base which could sweep out a large area before being repositioned. If crushing is employed in the base unit, nodules of any size could be collected and transported up the pipe string by an air-lift pump. This method would cover a mine site relatively efficiently and avoid the difficulty of other systems of towing a dredge head over the bottom without undue stress on the pipeline. Although a barge is mentioned in the patent, the one constructed was designed mainly to meet the needs of the CIA. Another connection to deep sea mining came when Lockheed recently publicly stated that it has been active for over 10 years in developing nodule mining and processing technology and that it has tested a mining system on land but has not yet proceeded to sea trials. Lockheed is now looking for partners and financing before going much further.

There is little doubt that the *Glomar Explorer* could be used for deep seabed mining but the expense of adapting it to a particular mining system would likely be prohibitive for a commercial operation. Its value at present would mainly be as a sophisticated research ship and platform for testing ocean mining equipment.

⁷ Now Howard Hughes Mines the Ocean Floor, *Business Week*, June 16, 1973, p. 47-50.

⁸ Hughes *Glomar Explorer* Begins Sea Tests of Mining Systems, *Ocean Industry*, March 1974, p. 32-34.

⁹ Alexander, Tom, Dead Ahead Toward a Bounded Main, *Fortune*, October 1974, p. 210.

¹⁰ Tinsley, *op. cit.*, p. 87.

¹¹ *Ocean Science News*, Mar. 21, 1975, p. 2.

¹² Washington Post, Mar. 19, 1975, p. A1, A10.

March 18, 1969

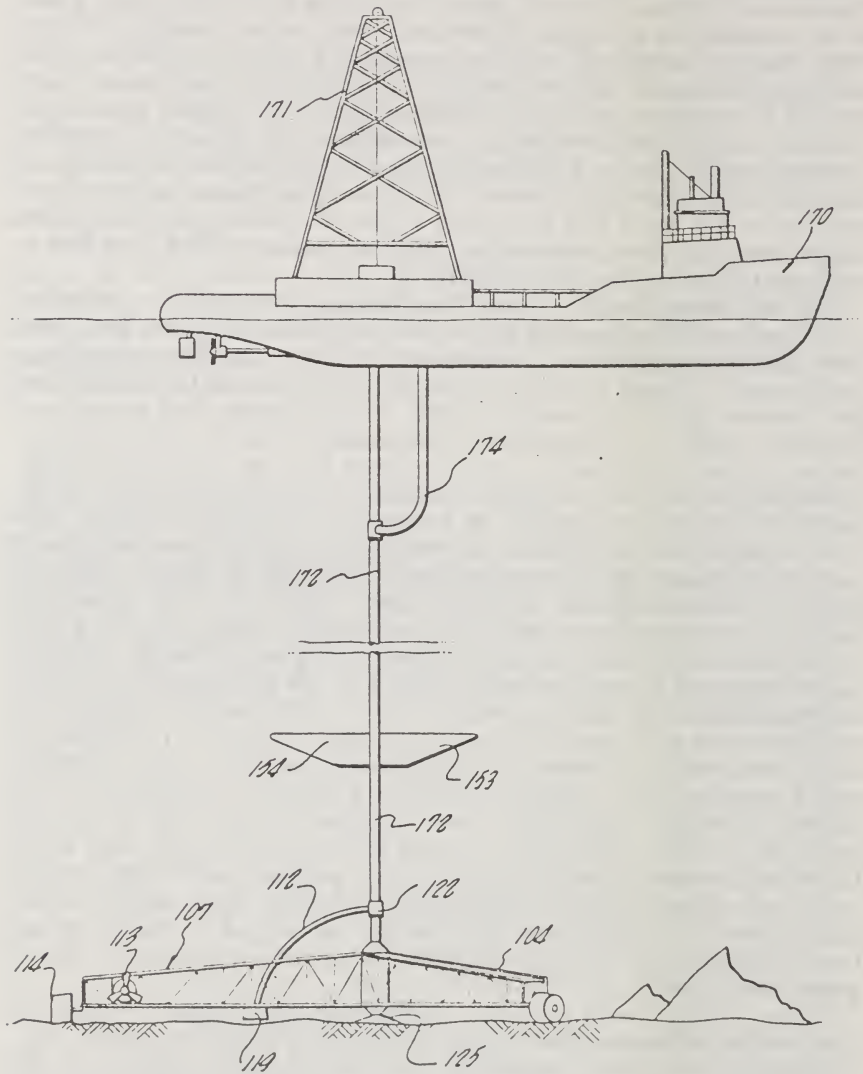
N. KOOT ET AL

3,433,531

METHOD AND APPARATUS FOR UNDERSEA MINING

Filed Dec. 27, 1966

Sheet 4 of 4



INVENTORS:
 NICK KOOT
 ROBERT W. NOLD
 BY *Charles P. ...*
 ATTORNEYS

FIGURE 14.—Patent issued to Global Marine, Inc.

After the CIA coverup story came out, Paul Reeve, general manager of the Summa Corporation, stated: "This equipment was developed as a prototype mining ship, and this is its objective."¹³ Mr. Reeve is also reported to have acknowledged that extensive tests of the Hughes mining system still need to be concluded before he could make any predictions as to when Summa might actually produce nodules from the ocean floor.

Jack Flipse, president of Deepsea Ventures, regarded the Summa Corp. as a legitimate mining interest which took on a related assignment for the CIA. He was reported to observe that up to about a year and a half before the CIA story broke, the company was working hard on its technology for processing manganese nodules. Suddenly, their efforts in that area ceased and the only reports of the Hughes ocean mining activities that surfaced were those concerning the ship and barge system design.¹⁴

INTERNATIONAL CONSORTIA

The recent trend of many firms to form international consortia to mine the ocean floor is claimed to have many advantages. In the absence of an international agreement regarding exploitation of the deep seabed, one advantage is broadened government support. Other advantages include the benefits of diverse capabilities, pooled investments, and shared risk.

The first international consortium to be formed for commercial exploitation of manganese nodules was the Kennecott group. This consortium, formed in January 1974, plans a \$50 million five-year research and development program to determine the feasibility of mining ferromanganese nodules from the deep seabed and extracting metals from them.¹⁵ The operation will be managed by Kennecott Copper Corp. which has a 50 percent interest in the venture. A portion of Kennecott's interest is derived from the value assigned to its prior experience in deep seabed mining. The group is composed of two British firms, Rio Tinto Zinc Corp. with 20 percent interest and Consolidated Gold Fields Ltd. with 10 percent interest, the Japanese Mitsubishi Corp. with 10 percent interest and Noranda Mines Ltd. of Canada with 10 percent. A loan of up to \$1.8 million has been offered to the British firms by the British government to be repaid when the venture first becomes commercial.

The second U.S. firm to announce participation in an international consortium to mine ferromanganese nodules was Tenneco's Deepsea Ventures, Inc. The initial members of this consortium were all Japanese trading firms: Nichimen Co., Ltd., C. Itoh and Co., Ltd., and Kanematsu-Gosho, Ltd.¹⁶ The Consortium was reorganized in November 1974 to provide a wider base of international support. Two new members included Essex Iron Co. (wholly owned by United States Steel) and Union Mines, Inc. (wholly owned by Union Miniere, S.A. of Belgium). Ownership is set up as follows: private investors in Deepsea Ventures to have 5 percent; Tenneco to divide the remaining 95 percent equally four ways (if all options are exercised) among itself, the two new members, and Japan Manganese Nodule Develop-

¹³ *Ocean Science News*, Mar. 21, 1975, p. 1.

¹⁴ *Ibid.*, p. 1.

¹⁵ *Oceanography Newsletter*, v. 9, No. 3, Feb. 4, 1974, pp. 1-2.

¹⁶ *Oceanography Newsletter*, v. 9, No. 9, May 13, 1974, p. 1.

ment Co., Ltd. (Jamco), which was set up by four Japanese companies. The agreement is to jointly assess a selected Pacific Ocean nodule deposit, scale-up and test mining and processing systems, and market-test the products recovered. The marketing program will be aimed at the signing of purchasing agreements prior to any commitment to begin a full-scale, commercial mining operation. Deepsea Ventures is to handle the mining and processing. The national groups will use proportionate shares of the metals in their respective domestic economies or worldwide trade. The total project is expected to cost approximately \$200 million from development and evaluation through commercial operation. It is estimated that as many as 10 mining units, each with a capacity of a million tons per year, could be operating in the 1980's.¹⁷ Recent reports indicate that the Japanese are dropping out of this consortium and that Tennaco is reducing its interest.

The CLB Group also involves U.S. firms. This group, involving about 20 major companies in six countries, is a joint effort to develop a \$5-million CLB system to full production.¹⁸ The CLB Group was initially organized in 1971 and has been reorganized several times since. Participants in the CLB Group include Nippon and the Sumitomo Industries in Japan, France's Societe Le Nickel and CNEXO, Australia's Broken Hill Proprietary (BHP) steel and oil group, Canada's International Nickel Co. (INCO), Dome Mines, Placer Mining, Teck Corp., Noranda Mines Ltd., and Cominco Ltd., and a German combine of Preussag AG, Metallgesellschaft AG and Salzgitter AG. U.S. firms participating include Ethyl Corp., Occidental Minerals, Phelps-Dodge, N.L. Industries, Superior Oil, Utah International, U.S. Steel, General Crude Oil, and Atlantic Richfield Oil. The consortium is managed by Dr. John L. Mero, president of Ocean Resources, Inc., of La Jolla, California. According to Dr. Mero, "The CLB aim is to get the system running on a full production basis to see what the costs and problems are by 1975. If everything looks good, then the group would break up and the individual companies would go their own ways in mining efforts."¹⁹ This type of consortium which will not continue through full-scale commercial production is a departure from the other consortia arrangements.

Another international consortium for deep seabed nodule mining was formed early in 1975 by International Nickel Co. of Canada Ltd. (INCO) with its U.S. subsidiary, The International Nickel Co. Inc., the West German AMR group consisting of Metallgesellschaft AG, Preussag AG, Rheinische Braunkohlenwerke AG, and Salzgitter AG, and the Japanese group organized under the name Deep Ocean Mining Co. Ltd. (DOMCO) which represents six firms from the Sumitomo combine, Ataka and Co. Ltd., Tovo Menka Kaisha Ltd., Maurbeni Corp., Kyokuyo Co. Ltd., Dowa Mining Co. Ltd., Nijvson Mining Co. Ltd., Shinko Electric Co., Nissho-Iwai Ltd., Tokyo Rope Manufacturing Co. Ltd., and Mitsui OSK Alliance Ltd.²⁰ Another U.S. participant, Sedco Inc., joined the consortium later in the year. Each group will have an equal interest in the project.

The agreement calls for the parties to proceed with design and development work to determine the economic and technical feasibility

¹⁷ Deep-Ocean Mining Takes a Step Ahead, *Ocean Industry*, March 1975, p. 82.

¹⁸ *Oceanography Newsletter*, v. 9, No. 12, June 24, 1974, pp. 1-2.

¹⁹ *Ibid.* p. 1.

²⁰ *Ocean Science News*, Apr. 11, 1975, p. 1.

of deep sea nodule mining. If results are favorable, the consortium will progress to commercial-scale mining and recovery of metals from manganese nodules. Most of the members of this consortium have been participants in the CLB Group.

FOREIGN INTERESTS

More than 100 companies around the world are now engaged in various aspects of exploiting mineral resources from the ocean floor. Some of the major foreign nodule mining interests are listed below. These firms represent a spectrum ranging from mining companies and engineering firms to trading firms and banks. Most of these firms are now involved in joint ventures either nationally or with international consortia.

Australia : Broken Hill Proprietary.

Belgium : Union Minere.

Canada :

Cominco Ltd.

Dome Mines.

International Nickel Company.

Noranda Mines Ltd.

Placer Mining.

Teck Corp.

Federal Republic of Germany :

Metallgesellschaft A.G.

Preussag A.G.

Rheinische Braunkohlenwerke A.G.

Salzgitter A.G.

France :

Centre National pour l'Exploitation des Oceans (CNEXO).

Société Le Nickel.

Great Britain :

Consolidated Gold Fields Ltd.

Rio Tinto Zinc Corp.

Japan : So far 33 Japanese firms have joined various international or national consortia to engage in deep seabed mining activities. Some of the principal firms are :

Ataka and Co. Ltd.

C. Itoh and Co., Ltd.

Dai-Ichi Kangyo Bank.

Dowa Mining Co. Ltd.

Fuji Bank.

Furutaka Shoji.

Hitachi Shipbuilding and Engineering.

Idemitsu Kosan Co. Ltd.

Kanematsu-Gosho Ltd.

Komatsu Ltd.

Kokuyo Co. Ltd.

Mitsubishi Corp.

Mitsui Osk Alliance Ltd.

Marubeni Corp.

Nichimen Co., Ltd.

Nijyson Mining Co. Ltd.

Nippon Steel.

Nissho-Iwai Ltd.

Pacific Metals.

Sanwa Bank.

Shinko Electric Co.

Sumitomo Metal Mining.

Sumitomo Shoji.

Sumitomo Shipbuilding and Machinery.

Tokyo Rope Manufacturing Co. Ltd.

Toyo Menka Kaisha Ltd.

PROBLEMS IN DETERMINING THE ECONOMIC IMPACT OF NODULE MINING

Commercial mining of manganese nodules will have a significant impact on the world metals market. In attempting to assess the extent of this impact and project long range forecasts, several problems are encountered.

The economic impact of nodule mining is dependent on several variables including the establishment of an international authority or legal framework, size of operations, metal production per ton of nodules, and timing of commercial operations. The amount of profit derived by the industry will determine to a fair extent the rate of development and subsequent impact of nodule mining. Since a commercial nodule industry is not yet an ongoing reality and the methodology is not yet proven under full scale prolonged operations, there is some question as to how attractive the economic returns will be. Although industry spokesmen are generally optimistic about the profits of nodule mining, hazards and technical difficulties are numerous.

ESTABLISHING AN INTERNATIONAL AUTHORITY

The establishment of a favorable international regime for deep seabed exploitation will also influence the extent and timing of the economic impact of nodule mining. In the last five years, several proposals for a new treaty on ocean resources have been submitted to the United Nations, and the member nations have been actively preparing for, and finally participating in, the third U.N. Law of the Sea Conference. Pending conclusion of a workable system, companies have been hesitant to invest the amounts of money necessary to proceed to commercial operations without some assurance of security for their investment. Any projection of a time scale for future metal production from nodules would have to assume the establishment of an international regime or reasonably secure and profitable investment climate in order to make realistic estimates. In a recent United Nations report on the economic implications of deep seabed mineral development, projections of metal production from nodules were made based on the assumption that an internationally agreed legal framework will come into force by 1976.²¹ However, unless there is more substantive progress at further sessions of the Law of the Sea Conference, many observers feel that such an assumption would be very optimistic.

SIZE OF OPERATION

Another factor that will influence the economic impact of a nodule mining industry is the size of the industry. As in most manufacturing or processing operations, there is an economy of scale. That is, there is a point up to which the unit cost is reduced by scaling up the size of the operation. For manganese nodules the economies of scale are much greater for the processing stage. This means that the unit costs probably still decrease for plant sizes capable of processing up to 3 to 4 million tons of dry nodules per year. On the other hand, hydraulic or air-lift nodule recovery systems apparently reach their optimum size at a capacity of 5,000 to 10,000 tons of wet nodules per day. This would provide a processing plant with 1 to 2 million tons of dry

²¹United Nations, A/CONF.62/25, *op. cit.*, p. 26.

nodules per year. Consequently, a mining company may be expected to operate 2 or 3 mining rigs and a plant designed to process 3 to 4 million tons per year. However, Deepsea Ventures, which intends to produce high purity manganese for which the world market is relatively small, initially plans a plant of only about 1 million tons of nodules per year.

METAL PRODUCTION PER TON OF NODULES

Processing techniques and grade of the nodules will determine the metal production per ton of nodules which effects the economic impact. Industry sources have generally indicated that the minimum metal enrichment for a nodule deposit to be economically profitable is on the order of 2 to 2.5 percent combined copper and nickel. High cobalt values could lower the acceptable copper plus nickel grade if a company were more interested in marketing cobalt. The amount of metal recovered depends on the efficiency of the metallurgical process developed. Indications at present are that industry may obtain yields on the order of 90 to 95 percent of the major metals from the nodules. Trace metals such as molybdenum, vanadium, zinc, silver, the platinum group, etc., may be recovered at slightly lower yields on the order of 80 percent. Table 5 is a projection by the United Nations for metal production per million tons of nodules. These projections assume an average metal content that may be somewhat higher than a typical commercial grade deposit would assay. From public comments of industry spokesmen, commercial deposits may average 28 percent manganese, 1.25 percent nickel, 1.1 percent copper, and 0.25 percent cobalt. An average metallurgical recovery efficiency of 95 percent may also be more likely initially. Using these figures a one million ton per year operation might be expected to produce 252,000 tons of manganese, 11,900 tons of nickel, 10,500 tons copper, and 2,400 tons cobalt. In terms of 1973 U.S. imports, a one million ton per year plant (the minimum size likely) could provide approximately 6 percent of nickel imports, 2.5 percent of copper imports, and 19 percent of cobalt imports. Comparisons of nodule production to manganese imports are generally misleading because most manganese imports are not converted to the higher value higher purity metal which would be the product of nodule processing.

TABLE 5.—ESTIMATED METAL PRODUCTION PER MILLION TONS OF HIGH GRADE NODULES (METRIC TONS)

Metal	Metal content per weight of dry nodules (in percent)	Approximate metal production per mil- lion tons of dry nodules (in tons) ¹
Manganese (if recovered).....	24.0	230,000
Nickel.....	1.6	15,000
Copper.....	1.4	13,000
Cobalt.....	.21	2,000
Other metals.....	.3	2,500

¹ Assuming 95 percent metallurgical recovery except for trace metals where an 80 percent rate is assumed.

Source: Ibid., p. 28.

Another estimate of metal recovery from nodules by U.S. mining interests in 1985 was prepared by Robert Nathan Associates for the Senate Committee on Commerce, National Ocean Policy Study

(Table 6). This study assumed entry into commercial operation of one U.S. mining firm of one million tons annual capacity and two firms each of 3 million tons annual recovery for a total of 7 million tons per year. The firm with the smaller recovery (Deepsea Ventures) would be the only U.S. mining interest recovering manganese. The recovery efficiency of the major metals by this firm was projected at 95 percent. The recovery efficiency of the other firms was projected somewhat lower at 80 percent.

TABLE 6. ESTIMATED 1985 RECOVERY OF METALS BY U.S. DEEP-OCEAN MINING ENTERPRISES, AND VALUE AT 1973 PRICES

Item	Nickel	Copper	Cobalt	Manganese
Approximate average content in initially mined ore (percent).....	1.25	1.15	0.25	28
Deep-sea ventures—1,000,000 tons of ore:				
Recoverable metal (tons) per 100 tons of ore at 95 percent recovery rate.....	1.2	1.1	.24	27
Tons of metal recovered (thousands).....	12	11	2.4	270
Other operations—6,000,000 tons of ore: ¹				
Percent of metal recovered.....	80	80	50	-----
Recoverable metal (tons) per 100 tons of ore.....	1.00	.92	.12	-----
Tons of metal recovered (thousands).....	60	55	7.2	-----
Total tons of metal recovered (thousands).....	72	66	9.6	270
Price per ton (dollars)(1973) ²	3,050	1,200	5,740	660
Gross value at 1973 prices (millions of dollars).....	220	79	55	180

¹ Original data from "Manganese Nodules (11): Prospects for Deep-sea Mining," *Science*, Feb. 15, 1974, pp. 644-646.

² U.S. Bureau of Mines, Commodity Data Summaries, 1974.

Source: U.S. Congress. Senate. Committee on Commerce, national ocean policy study, *The Economic Value of Ocean Resources to the United States*. Committee Print, 93d Cong. 2d sess. U.S. Government Printing Office, Washington, D.C., 1974, p. 21.

TIMING OF NODULE OPERATIONS

The time schedule for entry of companies into commercial nodule mining operations will influence the economic impact of metals from the deep seabed. As each company enters the commercial phase, the total amount of metals extracted will increase. However, at this time any definite schedule of events is purely speculative. No commercial-scale processing facilities are under construction and full-scale mining operations are not likely to begin much in advance of the completion of the processing plant. Even if full-scale mining equipment were completed, tested, and utilized to stockpile nodules, the world metals market would not be affected until the nodules were processed. Due to the lag time in design and construction, it does not appear likely that full-scale processing will begin before 1979 or 1980. Assuming no major delays from technical problems or an international authority, a world wide production of 15 million metric tons of dry nodules could be reached by 1985.^{22 23} Production from consortia involving U.S. firms could be expected to account for half that total or about 7 million tons (assuming 2 operations of 3 million tons each and one operation of 1 million tons).

²² United Nations. A/CONF 62/65, *op. cit.*, p. 31.

²³ U.S. Congress. Senate. Committee on Interior and Insular Affairs. Mineral resources of the deep seabed. Hearings before the Subcommittee on Minerals, Materials and Fuels on S. 1134. 93d Congress, 1st session. May 17, June 14, 15, 18, and 19, 1973. Washington, D.C., U.S. Govt. Print. Off., 1973, 768. p. 201-221.

ECONOMIC IMPACT OF NODULE MINING

In attempting to predict the economic impact of nodule mining, variables other than the future metal production from nodules must be considered. Two such variables are the future metal production from traditional sources and projected demand for these metals. Supply and demand are also related to price. One method of assessing the economic impact of nodule mining is to estimate the degree of market penetration or share of the market each metal produced from nodules is likely to have. The assumption is made that supply will equal total consumption.

Projections of demand for the four major metals recovered from manganese nodules vary widely from one source to another. Projections compiled for the House Subcommittee on Oceanography by the Congressional Research Service are presented in Table 7.²⁴ Unless new uses for cobalt can be found, demand for this metal is likely to remain small. Output from nodule mining could significantly affect the cobalt market. By 1985 U.S. nationals recovering 7 million tons of dry nodules would be able to satisfy nearly two-thirds of projected U.S. needs for cobalt and more than one-third of world demand.

²⁴ U.S. Congress. House. Committee on Merchant Marine and Fisheries. Deep seabed hard minerals. Hearings before the Subcommittee on Oceanography on H.R. 9 and H.R. 7732. 93d Cong. Mar. 1, 28, 29, Apr. 3, 1973, and H.R. 12233 Feb. 26, 27, 28, 1974. Washington, D.C., U.S. Govt. Print. Off., 1974, p. 347.

TABLE 7.—MANGANESE NODULES: COMMERCIALY ATTRACTIVE CONSTITUENTS PROJECTIONS FOR FUTURE DEMAND

Commodity	Unit	U.S. production 1971	World production 1971	United States: 1985		Total world: 1985		United States: 2000		Total world: 2000	
				Low estimate	High estimate	Low estimate	High estimate	Low estimate	High estimate	Low estimate	High estimate
Manganese	Short ton	0	22,792,130 ²	1,700,000	1,950,000	13,700,000	17,950,000	2,265,000	2,900,000	18,265,000	23,900,000
Cobalt	do	Negligible	25,867 (Co content)	14,650	17,050	25,850	28,250	26,000	34,300	40,550	48,850
Nickel	do	15,654	706,069 (Ni content)	356,000	414,000	960,000	1,018,000	632,000	833,000	1,464,000	1,665,000
Copper	do	1,322,183 (recoverable)	6,664,079 (Cu content)	3,600,000	4,200,000	11,200,000	13,500,000	6,000,000	7,800,000	15,700,000	20,600,000

¹ Includes 2,581 short tons recovered as a byproduct of metal refining.² Figure given is gross weight manganese ore (35 percent or more Mn content).

Sources: (1) "Marine Resources and Legal-Political Arrangements for Their Development". U.S.

Commission on Marine Science, Engineering and Resources. Washington: 1969. pp. VII-133, 134, 140, 142.

(2) "Minerals Yearbook, 1971," volume I. U.S. Bureau of Mines. Washington: 1973. pp. 409, 491-492, 724, 825.

According to recent statements by Deepsea Ventures, pure manganese metal will not be recovered from nodules but other high purity forms of manganese will be produced. The demand for high purity forms of manganese of greater value than high carbon ferromanganese is relatively low, although greater than the demand for pure manganese metal. One U.S. firm with the capability to produce one million tons (dry weight) of nodules per year intending to market manganese in the form of low or medium carbon ferromanganese could more than satisfy the projected U.S. demand in 1985 and approximately equal the U.S. demand in 2000. If the silicomanganese market were also entered, a larger manganese production could be marketed. In any event, the impact on the markets for these forms of manganese would be significant, but there would be relatively little impact on the much larger manganese ore and high carbon ferromanganese markets.

The markets for copper and nickel are large enough that they will likely not be significantly affected by nodule mining in 1985. If U.S. mining ventures recovered 5 million tons of dry nodules per year, they would supply 18 percent of the projected U.S. demand for nickel in 1985 and only 1.5 percent of the U.S. demand for copper.

In projecting the value of metals processed from nodules to the U.S. economy in 1985 and 2000, the report for the National Ocean Policy Study determined a value of \$387 million by 1985 and \$835 million by 2000 (Table 8). This projection assumed production of metallic manganese and a drop in the price of cobalt and manganese metal compared to Table 6.

TABLE 8.—PROJECTED MARKET VALUE OF U.S. PRODUCTION OF METALS FROM MANGANESE NODULES IN 1985 AND 2000
[In 1973 dollars]

Metals	1985			2000		
	Output (thousand short tons)	Price (per ton)	Value (millions)	Output (thousand short tons)	Price (per ton)	Value (millions)
Manganese.....	270.0	\$200	\$54	540.0	\$200	\$108
Cobalt.....	9.6	1,500	14	19.2	1,500	28
Nickel.....	72.0	2,900	209	144.0	3,040	438
Copper.....	66.0	1,660	110	132.0	1,980	261
Total.....			387			835

Source: The Economic Value of the Ocean Resources to the United States, op. cit., p. 26.

Based on an assumed production of 15 million tons of dry nodules by 1985, the United Nations forecasted the impact on the world metals market. The United Nations forecast (Table 9) multiplied the metal recovery per million tons of dry nodules from Table 5 by 15. This calculation is valid mainly for nickel and copper which are the major metals of interest to the nodule industry. In the case of manganese, only two companies or groups have announced their intentions to produce this metal; consequently, estimates of manganese production are based on only 4 million tons of nodules. Manganese production could

be higher than 920,000 tons if more companies recover the metal. On the other hand, the market for refined manganese is relatively small and not likely to be cost competitive with high carbon ferromanganese used in steelmaking. Consequently, since low purity manganese cannot compete with land ores and the additional cost of refining manganese from nodules will not justify the return for most companies, manganese production from nodules may be much lower than the U.N. estimate. Cobalt and minor metals are quite variable in nodules, and have relatively high concentrations in some deposits. Production of cobalt and other minor metals could be higher than the U.N. estimates in Table 9.

TABLE 9.—MANGANESE, NICKEL, COPPER, AND COBALT: PROBABLE PRODUCTION FROM NODULES, ESTIMATED WORLD DEMAND AND ESTIMATED NET IMPORT REQUIREMENT OF INDUSTRIAL COUNTRIES IN 1985

[Thousand metric tons]

	Probable production from nodules	Estimated world demand	Production from nodules as a percentage of world demand	Estimated net import requirement of industrial countries ¹	Production from nodules as a percentage of net import requirement of industrial countries
Manganese ²	920	16, 400	6.0	7, 300	13. 0
Nickel.....	220	1, 220	18.0	770	26. 0
Copper.....	200	14, 900	1.3	³ 3, 600	5. 5
Cobalt.....	30	³ 60	50.0	NA	NA

¹ Assuming that net import requirements would be proportionately the same as in 1972.

² Manganese recovery is assumed from only 4 million tons of nodules.

³ Excluding the centrally planned economies.

Source: United Nations, A/CONF.62/25, *op. cit.*, p. 42.

A working paper on the economic effects of deep seabed exploitation was submitted in 1974 by the United States delegation to the law of the Sea Conference in Caracas. This paper pointed out the interests of all consumers in encouraging seabed output and the unlikelihood that the income of existing producers would decrease even with seabed production. In some respects, this paper was a rebuttal to a few of the projections made in the recent economic report of the U.N. Secretary-General.²⁵ The U.S. working paper tabulated the approximate values of mineral production from each country and projected these to 1980 and 1985 (Tables 10 and 11). Production from seabed mining was also estimated for 1980 and 1985. Particular reference is made to the production from developing countries (Group of 77) which have expressed great concern for the possible loss of export revenues and have taken a firm position at the Law of the Sea Conference for complete U.N. control of seabed mining. An important point highlighted in Table 11 is that the projected income of individual land-based producers from their production of the four metals will increase significantly between the present and 1985, even with seabed mining.

²⁵ United Nations, A/CONF. 62/25, *op. cit.*, 92 p.

TABLE 10.—APPROXIMATE 1971 VALUE OF MINERAL PRODUCTION ¹

[Dollar amounts in millions of 1971 dollars]

	Cobalt	Copper	Manganese	Nickel	Total	Percent of world output
I. Total.....	\$115	\$6, 125	\$223	\$445	\$6, 908	100. 00
II. Group of 77 countries.....	88	2, 602	98	45	2, 833	40. 0
III. Other countries.....	27	3, 523	125	400	4, 075	60. 0
Nongroup of 77:						
United States.....		1, 522		9	1, 531	22. 0
Canada.....	11	720		186	917	13. 0
Union Soviet Socialist Republic.....	8	680	76	80	844	12. 0
Australia.....	2	195	11	22	230	3. 0
South Africa.....		174	36	9	219	3. 0
Japan.....		133	2		135	2. 0
Poland.....		99			99	1. 0
France.....				71	71	1. 0
Rhodesia.....				9	9	. 1
Finland.....	6				6	. 1
Greece.....				9	9	. 1
Group of 77 producers:						
Chile.....		790			790	11. 0
Zambia.....	10	718			728	10. 0
Zaire.....	65	449	4		518	7. 0
Peru.....		235			235	3. 0
Philippines.....		230			230	3. 0
China.....		110	12		122	2. 0
Mexico.....		70	2		72	1. 0
Cuba.....	8			27	35	. 5
Brazil.....			29		29	. 4
Gabon.....			20		20	. 3
India.....			20		20	. 3
Indonesia.....				18	18	. 3
Morocco.....	5				5	. 1
Ghana.....			7		7	. 1

¹ Note: See bottom Table 11 for source and comments.TABLE 11.—APPROXIMATE VALUE OF MINERAL PRODUCTION ¹

[Dollar amounts in millions of 1971 dollars]

	Cobalt	Copper	Manganese	Nickel	Total	Percent
Landbased:						
Group of 77 producers:						
1971.....	\$88	\$2, 602	\$98	\$45	\$2, 833	40
1980.....	99	4, 036	110	131	4, 376	41
1985.....	106	5, 214	150	175	5, 645	41
Other countries:						
1971.....	27	3, 523	125	400	4, 075	60
1980.....	31	5, 346	200	486	6, 063	56
1985.....	34	6, 755	213	650	7, 654	55
Seabeds:						
1971.....	0	0	0	0	0	0
1980.....	70	123	12	135	340	3
1985.....	120	158	33	181	492	4
Total:						
1971.....	115	6, 125	223	445	6, 908	100
1980.....	200	9, 505	322	752	10, 779	100
1985.....	260	12, 127	396	1, 006	13, 789	100

¹ Countries are listed in rank order of the total value of the four metals in question. The countries listed produce at least 1 percent of the world production of one of the metals listed.

Source: Data is extrapolated from UNCTAD documents TD/B/449/Add 1; TD/B/484; TD/B/483; TD/113/Supp. 4; U.N. document A/Conf.62/25; and U.S. Department of the Interior 1971 "Minerals Yearbook."

Based on recent information regarding participation by U.S. firms and U.S. subsidiaries of foreign interests in international consortia and U.S. Bureau of Mines projections of annual increases in domestic demand for the metals contained in nodules,²⁶ another projection can be made of the benefit to the United States from nodule mining operations. The Bureau of Mines projections of annual increases in domestic demand through 1980 are extended at the same rate through 1985 and 2000. These projections are: manganese 2 percent, nickel 3 percent, copper 3.5 percent, and cobalt 3 percent. While this extension is somewhat speculative, it is probably within the acceptable range. Straight projection of these annual increases in demand lead to estimates of domestic consumption in 1985 of 420,000 short tons of silicomanganese plus low and medium carbon ferromanganese, 340,000 tons nickel, 3,400,000 tons copper, and 13,000 tons cobalt. These projections are generally lower than those cited previously as they place more emphasis on current economic conditions. On the other hand, newer projections by the Bureau of Mines indicate that U.S. demand for some of these metals by 1985 and the year 2000 may even be lower.²⁷

All of the international consortia have U.S. participants who control from approximately 20 to over 50 percent of the consortium. Assuming recovery rates of 3 million tons of nodules per year for each consortium (Deepsea Ventures announced in its Notice of Claim, Appendix D, that it contemplates future recovery of approximately this amount), the total amount of nodules processed and marketed by U.S. firms in 1985 could range from 4 to 5 million tons (Table 12). An additional .5 to 1.0 million tons, representing the share of U.S. subsidiaries of foreign firms, could also be added to the domestic market. Using a recovery of 5 million tons the following estimates of the percent of U.S. consumption in 1985 supplied from nodule mining by U.S. interests are made: 95 percent of the domestic demand for low and medium carbon ferromanganese plus silicomanganese, nickel 18 percent, copper 1.5 percent, and cobalt 92 percent (Table 13).

TABLE 12.—PARTICIPATION IN NODULE MINING CONSORTIA BY U.S. INTERESTS AND ESTIMATED NODULE RECOVERY BY 1985

Company	Total nodules controlled by U.S. interests (million tons)
U.S. firms.....	4-5
Deepsea Ventures	
Essex Iron	
Kennecott	
Lockheed	
Sedco	
Tenneco	
U.S. subsidiaries.....	.5-1
Union Mines	
International Nickel Co.	
Total U.S. firms and subsidiaries (million tons).....	4.5-6

In 1985 commercial deep seabed mining would still be in fairly early stages and could be expected to expand rapidly through the year 2000. Although highly speculative at this time, nodule recovery by U.S. interests in the year 2000 is projected here at 10 million tons annually,

²⁶ U.S. Bureau of Mines. Community Data Summaries 1976. U.S. Govt. Print. Office, 1976. P. 43, 47, 99, 113.

²⁷ U.S. Bureau of Mines, Mineral Facts and Problems, 1975 edition. In press.

TABLE 13.—PROJECTED U.S. CONSUMPTION AND PERCENT OF IMPORTS SATISFIED BY NODULE MINING OPERATIONS IN 1985 AND 2000

Metal	Estimated percent annual increase in U.S. consumption ¹	Projected U.S. consumption (short tons ²)		Estimated recovery from nodules by U.S. interests ³ (short tons)		Percent of U.S. consumption from nodules		Percent reduction of U.S. imports from nodules	
		1985	2000	1985	2000	1985	2000	1985	2000
Selected manganese materials ⁴	2.0	420,000	560,000	400,000	500,000	95.0	90.0	95.0	90.0
Nickel	3.0	340,000	530,000	60,000	120,000	18.0	23.0	24.0	31.0
Copper	3.5	3,400,000	5,600,000	52,000	105,000	1.5	1.9	8.5	10.4
Cobalt	3.0	13,000	23,000	12,000	24,000	92.0	100.0	94.0	100.0

¹ U.S. Bureau of Mines, Commodity Data Summaries 1976, pp. 43, 47, 99, 113.

² 1 short ton equals 2,000 lbs.

³ Assumes recovery of 5,000,000 tons (dry weight) of nodules per year by 1985 and 10,000,000 tons per year by 2000. For manganese materials, assumes recovery from 1,600,000 tons per year in 1985 and 2,000,000 tons per year by 2000.

⁴ Manganese materials considered here include silicomanganese plus low- and medium-carbon ferromanganese.

resulting in reductions in the projected levels of imports of 90 percent for the manganese materials selected, 31 percent of the nickel imports, 10.4 percent of the copper imported, and cobalt could be produced for export if not substituted for nickel in some uses to further reduce nickel imports.

These estimates are based on those companies that at this point in time are probably the most likely U.S. interests to be participating in commercial nodule mining operations by 1985. The U.S. participants in the CLB Group are not included, as that consortium was formed for exploration and development only, but not for commercial exploitation as a joint venture. However, the U.S. participants in the CLB Group may join consortia not yet announced, or existing consortia and, consequently, might also be involved in commercial nodule mining operations by 1985. Lockheed has developed nodule mining and processing systems, but the future role of Lockheed in deep seabed mining is still uncertain. However, it is assumed that if the investment security is favorable enough for other U.S. firms to enter into commercial nodule recovery, Lockheed will probably also be able to attract financing and possibly other U.S. firms as partners. For these reasons the estimates of metals recovered from nodules by U.S. firms in 1985 arrived at a Table 13 may be minimum amounts. The projections to the year 2000 assume roughly a doubling of the 1985 level of nodule recovery by U.S. interests.

Imports of manganese ore and standard (high carbon) ferromanganese account for the bulk of the U.S. demand for manganese and these imports would not likely be reduced by more than a few percent as the manganese materials produced from nodules would not compete in these lower priced markets. Based on 1975 prices, the above projection of nodule mining could supply the United States with approximately \$0.8 billion per year in metals by the year 2000. Nodule mining by other countries or foreign shares in consortia could likely total three to five times this amount per year by then.

NICKEL

Over 40 percent of the nickel consumed is used in stainless steel alloys to increase strength and corrosion resistance. Nickel-alloy steels are used in high temperature applications such as jet engines and turbines. Other uses include electroplating, resistance alloys in electrical equipment, pollution control equipment, chemical industry, and petroleum refining. World-wide consumption has increased at an average rate of about 6.5 percent per year over the last 25 years and prospects for a continued annual increase of at least 6 percent are likely.²⁸

In 1974, 73 percent of the U.S. demand for nickel was supplied by imports (Fig. 15). Consumption was reported at 273,000 short tons (including scrap). During the period 1971-74 the major import sources were: Canada 68 percent, Norway 8 percent, New Caledonia 6 percent, Dominican Republic 5 percent, and others 13 percent (Norway's raw material was nickel-copper matte from Canada).²⁹ The United States produces only about 7 percent of its nickel requirements and recycles

²⁸ United Nations A/CONF. 62/25, *op. cit.*, p. 34.

²⁹ U.S. Bureau of Mines, *Commodity Data Summaries 1976*, U.S. Govt. Print. Office, Washington, D.C. 1976, p. 112.

about 24 percent from scrap. Consumer stocks are estimated at 37,000 short tons of metal. Nickel is not currently stockpiled by the U.S. Government.

U.S. Bureau of Mines projections indicate domestic demand for nickel is expected to increase at an annual rate of about 3 percent through 1980.³⁰ Domestic production is expected to remain at the level set in the last 5 years. Barring unforeseen shortages and future cartels (see section on possible cartel action) supplies should be available from relatively secure foreign sources at prices comparable to those now prevailing. In 1972, the United States imported 24.6 percent of the world nickel production and produced 2.4 percent. World mine production and reserves are given in Table 14.

TABLE 14.—WORLD MINE PRODUCTION AND NICKEL RESERVES (SHORT TONS OF NICKEL)

Country	Mine Production		Reserves	
	1974	1975	Quantity	Grade of ore (percent)
United States.....	16,618	16,500	200,000	0.8-1.3
Canada.....	299,661	285,000	9,600,000	1.5-3
New Caledonia.....	142,800	140,000	26,000,000	1-5
Other market economy countries.....	188,344	200,000	16,100,000	0.2-4.0
Cuba ¹	35,000	35,000	3,400,000	1.4
Central economy countries.....	143,300	145,000	4,200,000	0.4-4.0
World total.....	825,723	821,500	59,500,000	

¹ Estimate.

Source: Commodity Data Summaries 1976, op. cit., p. 113.

There would appear to be no world supply problem to the year 2000 since the probable reserves at current prices are three times the probable cumulative demand. Supply is concentrated in a few industrialized countries. Canada, the Soviet Union, and France (New Caledonia) accounted for 74 percent of the world mine production in 1972. Developing countries produced less than 13 percent of the world total in 1972 but their output has been increasing. Developing countries may be assumed to produce as much as 20 percent of the world's nickel by 1985.³¹

Using the assumptions it developed, the U.N. report (A/CONF.62/25) estimated that world nickel production from nodules might account for about 18 percent of the total demand by 1985, Table 9. This degree of market penetration may depress prices somewhat but may not seriously affect traditional producers. High cost projects may not be developed. The working paper of the U.S. delegation to the Law of the Sea Conference pointed out that even with seabed mining, land based production will need to increase nearly 70 percent from the 1972 production level to meet anticipated demand by 1985. The U.S. working paper suggests that such a large increase in demand can be expected to result in increased prices such that a number of high cost land deposits which were marginal may become economically feasible. Furthermore, 30 percent of the increase in land production would come from developing countries.

³⁰ *Ibid.*, p. 113.

³¹ United Nations, A/CONF.62/25, op. cit., p. 34.

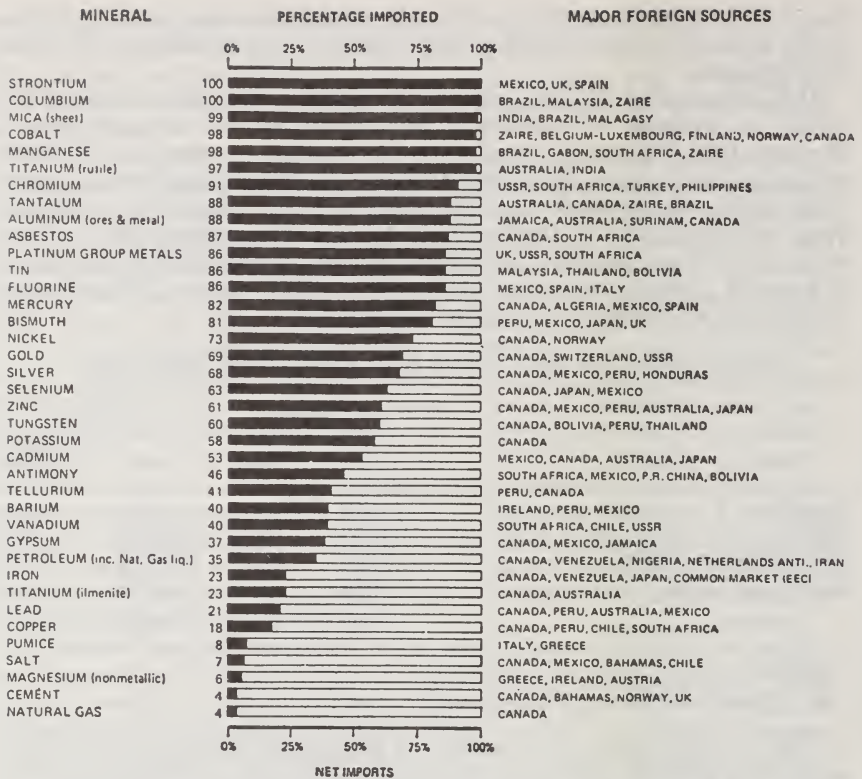


FIGURE 15.—IMPORTS SUPPLIED SIGNIFICANT PERCENTAGE OF TOTAL U.S. DEMAND IN 1974

Source: U.S. Bureau of Mines. Minerals and Materials/a monthly survey. U.S. Govt. Print. Office, Washington, D.C., December 1975, p. 6.

COPPER

Because of its electrical conductivity and corrosion resistance, copper is used extensively in electrical equipment, wire, tubing and sheeting, and in alloys. World wide demand for copper has been increasing at an average annual rate of 5 percent for the past 2 decades. Prospects for a continued increase in demand on the order of 4 to 5 percent per year are considered good through the end of the century.³² Copper is mined in 56 countries. Industrial countries are the largest producers and consumers with 46 percent of the total mined in 1972 coming from the United States, Canada, and the Soviet Union. Developing countries are the leading exporters, producing 42 percent of the 1972 world mine tonnage. In 1972, the United States produced 23 percent of the world production of copper and imported 2.4 percent of the world production.

In 1974, 18 percent of the U.S. demand for copper was supplied from imports. Consumption was reported at 2,194,000 short tons and 252,000 tons were released from the Government stockpile in 1974.

³² *Ibid.* p. 36.

During the period 1971-74 major import sources were: Canada 33 percent, Peru 22 percent, Chile 17 percent, Republic of South Africa 6 percent, and others 22 percent.³³ Approximately 20 percent of the copper consumed by the United States in 1974 was recycled from scrap. Producer stocks of refined copper are estimated by the Bureau of Mines at about 45,000 tons. Under authorization to dispose of the entire amount, the Government stockpile of copper was reduced close to zero in 1974. Sources of supply for the United States are relatively secure. Shortages of copper relative to demand in the United States have developed in the past due to a number of factors including: (1) A surge in world demand, (2) disruptions of production in Chile, Canada, and Belgium, (3) some curtailment in domestic output to meet air quality standards, (4) transport problems in Canada and Zambia, and (5) the effect of U.S. economic controls coupled with increasing world prices.

A summary of world production and copper reserves is listed in Table 15.

TABLE 15.—WORLD MINE PRODUCTION AND COPPER RESERVES

[In thousands of short tons of copper]

Country	Mine production		Reserves
	1974	1975 ¹	
United States.....	1, 597	1, 420	90, 000
Australia.....	282	250	10, 000
Canada.....	929	850	40, 000
Chile.....	998	900	86, 000
Peru.....	246	240	30, 000
Philippines.....	249	240	16, 000
Zaire.....	550	470	20, 000
Zambia.....	769	730	30, 000
U.S.S.R.....	816	820	40, 000
Other.....	1, 673	1, 680	88, 000
World total.....	8, 109	7, 600	450, 000

¹ Estimate.Source: Commodity Data Summaries 1976, *op. cit.*, p. 47.

The Bureau of Mines estimates hypothetical resources, located near known deposits, probably contain an additional 480 million tons of copper and a speculative 320 million tons is assigned to areas not yet prospected. It would appear that copper produced from manganese nodules would have only a minimal effect on copper supply and no effect on price.

At an increase in demand of 4 to 5 percent per annum as projected in the U.N. Secretary-General's report, world production would amount to nearly 15 million short tons or roughly twice current production by 1985. Consequently, nodule production is expected to have a very minor impact on the copper market, yielding only 200,000 tons or 1.3 percent of the total consumption (Table 9). Imports of copper by the industrial countries are likely to remain at around one-third of their consumption by 1985. The U.S. Bureau of Mines projects domestic demand for copper to increase at an average annual growth rate of 3.5 percent through 1980.

MANGANESE

More than 90 percent of the world production of manganese is used in steel making primarily as a scavenger for removing sulfur, oxygen,

³³ Commodity Data Summaries 1975, *op. cit.*, p. 44.

and trace impurities. Used as an alloy, manganese makes steel more resistant to shock or abrasion. Metallurgical ore and ferromanganese are the manganese materials most commonly used in steel making. The market for high purity forms of manganese is relatively small. Because of processing difficulties, high purity forms of manganese are the only forms of manganese expected to be marketed from nodules.

All of the manganese consumed in the United States in 1974 was either imported or released from government stockpile. Domestic production ceased in 1970 and there is essentially no recycling of manganese metal. During the period 1971-74 the major import sources of manganese ore were: Brazil 35 percent, Gabon 31 percent, Australia 9 percent, Republic of South Africa 8 percent, and others 17 percent. During the same period import sources of ferromanganese were: France 39 percent, Republic of South Africa 36 percent, India 8 percent, and others 17 percent. Total producer and consumer stocks are estimated by the Bureau of Mines to be about 1,500,000 short tons of manganese ore, which typically ranges from 35 to 54 percent manganese, and 250,000 tons of ferromanganese at 74 to 95 percent manganese. Industrial consumption in the United States in 1974 was 1,880,000 tons of manganese ore and 1,115,000 tons of ferromanganese. With regard to the manganese materials in the price range of materials that would likely be produced from nodules, U.S. consumption of low and medium carbon ferromanganese was 159,659 short tons in 1974 and consumption of silicomanganese was 177,166 short tons. The Bureau of Mines estimates domestic demand for manganese will increase at an annual rate of approximately 2 percent through 1980.

Several manganese materials are inventoried in the Government stockpile (Table 16). Assuming a requirement of 13 pounds of manganese per ton of raw steel produced, and an annual steel production of 120 million tons, the amount in the Government stockpile can be calculated to last about 3 years. World mine production and reserves are given in Table 17. Reserves alone are more than adequate to meet expected world demand for the balance of the century. Known land-based resources are very large and irregularly distributed throughout the world. The Bureau of Mines estimates U.S. resources could satisfy expected domestic demand for manganese to the year 2000. However, because these resources are much more expensive to process than foreign ores, domestic production has ceased.

TABLE 16.—STOCKPILE STATUS—NOV. 30, 1975

Material	Objective	Total inventory	Total excess	Available for disposal	Sales, 10 months
Battery:					
Natural ore.....	11	210	199	75	44
Synthetic dioxide.....		3	3	2	
Chemical:					
Type A ore.....	13	147	134	112	
Type B ore.....	13	81	68	46	1
Metallurgical ore.....	751	3,167	2,416	551	64
Ferromanganese:					
High carbon.....	200	600	400		
Medium carbon.....	11	29	18		
Silicomanganese.....	16	24	8		
Electrolytic metal.....	5	14	9		

Source: *Ibid.*, p. 96.

TABLE 17.—WORLD MINE PRODUCTION AND MANGANESE RESERVES

[In thousands of short tons of manganese]

Country	Mine production		Reserves
	1974	1975 ¹	
United States.....			
Australia.....	1,678	1,800	330,000
Brazil.....	2,000	2,000	95,000
Gabon.....	2,357	2,400	210,000
India.....	1,595	1,500	65,000
South Africa, Republic of.....	4,129	4,500	2,200,000
Other market economy countries.....	1,716	1,600	30,000
Central economy countries.....	10,700	11,000	3,000,000
World total.....	24,175	24,800	6,000,000

¹ Estimate.

Source: Commodity Data Summaries 1976, p. 99.

Demand for manganese is considered relatively stable and not likely to increase rapidly with increased supplies. The U.N. Secretary-General's report expects manganese demand to continue to increase at about 5 percent per year reaching approximately 16.4 million tons of manganese-in-ore by 1985. Estimates of manganese production from nodules are tenuous, but assuming recovery of 920,000 tons by 1985 as estimated by the U.N. report, this would amount to 5.6 percent of the estimated world demand of manganese in ore. However, since manganese from nodules is expected to be marketed only as premium priced manganese materials, this amount of production would approximately satisfy the world demand for these materials. Only if the pure metal could be marketed at a price competitive with standard high carbon ferromanganese would greater production from nodules be expected.

Developing countries currently produce about 56 percent of the world's manganese. According to the Secretary-General's report these countries may be expected to feel a significant impact from nodule mining. However, as the U.S. working paper pointed out, the Secretary-General's report failed to fully consider the uses of manganese and the market for manganese metal (primarily the small likelihood that ferromanganese from nodules would significantly replace high carbon ferromanganese or manganese ore in steelmaking). It seems unlikely that the assumption in the Secretary-General's report of a significant impact on land-based manganese producers from nodule mining will be realized. The only country where manganese is a significant export factor is Gabon, where it is 20 percent of the total value of the exports. Manganese represents 2 percent or less of the value of the exports from each of the other developing country producers (Brazil, India, Zaire, Ghana, and Morocco).

COBALT

Cobalt has important magnetic and chemical properties, and is resistant to high temperatures. Although it is used in a variety of industrial products, it has a relatively small market. At lower prices, cobalt could substitute for a number of other metals such as nickel in

a variety of uses. Cobalt is primarily produced as a by-product of copper and nickel refining.

Imports supplied over 98 percent of the U.S. demand for cobalt in 1974. U.S. consumption totaled 9,431 short tons. Shipments from government stockpiles were reported at 4,468 short tons and 135 short tons or a little over one percent of the domestic cobalt consumption was recovered from scrap. Domestic mine production ceased in 1971. The major import sources during the period 1971-74 were: Zaire 47 percent, Belgium-Luxembourg 29 percent, Finland 7 percent, Norway 7 percent, Canada 4 percent, Zambia 2 percent, and others 4 percent. The U.S. Bureau of Mines estimates consumer stocks of about 1,000 tons of metal. The Government stockpile status report for November 30, 1975, listed an objective of 5,972 tons of cobalt with a total inventory of 23,448 tons and an excess of 17,476 tons. At a consumption rate of 9,000 tons per year, the stockpile inventory would yield less than a 3-year supply and the objective would last 8 months. The U.S. demand for cobalt is projected by the Bureau of Mines to increase about 2.6 percent per year through 1980.

World mine production and reserves are summarized in Table 18. Two-thirds of the world's production comes from Zaire; however, increasing amounts are expected to come from other countries such as the Philippines, Australia, New Caledonia, Canada, and Zambia. Present land reserves are twice the cumulative world demand to the year 2000. The identified cobalt resources of the United States are estimated by the Bureau of Mines at more than 840,000 tons and world resources at more than 5,000,000 tons.

TABLE 18.—WORLD MINE PRODUCTION AND COBALT RESERVES

(In tons of cobalt)

Country	Mine production		Reserves	
	1974	1975 ¹	Quantity	Grade of ore (percent)
Canada	2,120	2,000	190,000	0.03-0.06
Morocco	1,932	1,900	14,000	1.6
New Caledonia and Australia ¹	850	800	740,000	0.1-5.0
Zaire	19,340	17,000	750,000	0.3-2.0
Zambia	3,490	3,500	380,000	0.05-0.25
Other market economy countries	2,072	2,000	25,000	0.1
Central economy countries	3,700	3,700	1 600,000	0.07-0.1
World total	33,504	30,900	2,700,000	

¹ Estimate.

According to the projections in the Secretary-General's report, world demand for cobalt is expected to increase 6 to 8 percent per year through 1985. From this, the report concludes that world demand may reach 60,000 tons by 1985 with 30,000 tons recovered from nodules. Consequently, the price will start falling once cobalt recovered from

nodules reaches the market. Cobalt produced from domestic mining operations, recovering a total of 7 million tons of nodules per year, would assure a domestic source for all the U.S. needs to the year 2000.

LONG-TERM ECONOMIC PROSPECTS OF NODULE MINING

Sustained long-term development of the nodule industry will depend on its position relative to other sources of metal supply such as recycling and land mining. Technological developments, possible institutional constraints, and market conditions all affect the relative competitive position of metals supply. Industry sources indicate that the first generation of nodule mining will likely be very profitable. Once the industry expands into a second generation of investment and technology, possible declines in revenues may not be offset by reductions in cost. Once a metal becomes abundant, its price will fall to the level of its most important substitute.

If half of the world demand is supplied from nodule mining by 1985, cobalt is likely to be one of the first price casualties. Its price would eventually fall to the price level of nickel. High purity manganese materials are also vulnerable. One nodule operation of one million tons per year could supply a large fraction of the projected world demand for premium manganese materials by 1980. If this amount of high purity manganese could be marketed economically, it would likely cause the substitution of premium manganese materials in other uses as the price fell. Molybdenum may also be supplied from nodules in great abundance relative to demand. Possibly declining prices of cobalt, manganese, and molybdenum are not expected to affect severely the profitability of the nodule mining industry. Profits will be based mainly on nickel and copper. Nickel and copper from nodules would least affect their world markets and would remain the long-term profit basis of the nodule mining industry.

Although not precisely known, the extent of the world-wide ferromanganese nodule reserves bears mention. Reserves are currently estimated to be on the order of 1.5 trillion tons in the Pacific Ocean alone.³⁴ Unlike many resources, ferromanganese nodules are currently forming. The rate of formation in the Pacific Ocean has been estimated at 6 to 10 million tons per year.³⁵ Most of the nodules are not economically minable. Consequently, the minable reserves are probably on the order of 10 billion to 500 billion tons.³⁶ For comparison, future mining operations could be expected to recover 15 to 20 million tons per year by the end of the next decade. One estimate of the reserves of metals in manganese nodules of the Pacific Ocean and the number of years these might last at the consumption rate of 1960 is given in Table 19.

³⁴ Mero, J. L. Potential economic value of ocean-floor manganese nodule deposits. In *Ferromanganese Deposits on the Ocean Floor*, Horn, D. R., ed., IDOE, National Science Foundation, Washington, D.C. 1972: 191-203.

³⁵ *Time*, July 29, 1974, p. 57.

³⁶ Mero, *op. cit.*, p. 202.

TABLE 19.—RESERVES OF METALS IN MANGANESE NODULES OF THE PACIFIC OCEAN

Element	Amount of element in nodules (billions of tons) ¹	Reserves in nodules at consumption rate of 1960 ² (years)	Approximate world land reserves of elements ³ (years)	Ratio of (reserves in nodules) (reserves on land)	U.S. rate of consumption of element in 1960 ⁴ (millions of tons per year)	Rate of accumulation of element in nodules (millions of tons per year)	Ratio of (rate of accumulation) (rate of U.S. consumption)	Ratio of (world consumption) (U.S. consumption)
Magnesium..	25	600,000	⁵ L	-----	0.04	0.18	4.5	2.5
Aluminum..	43	20,000	100	200	2.0	.30	.15	2.0
Titanium...	9.9	2,000,000	L	-----	.30	.069	.23	4.0
Vanadium..	0.8	400,000	L	-----	.002	.0056	2.8	4.0
Manganese..	358	400,000	100	4,000	.8	2.5	3.0	8.0
Iron.....	207	2,000	⁶ 500	4	100.	1.4	.01	2.5
Cobalt.....	5.2	200,000	40	5,000	.008	.036	4.5	2.0
Nickel.....	14.7	150,000	100	1,500	.11	.102	1.0	3.0
Copper.....	7.9	6,000	40	150	1.2	.055	.05	4.0
Zinc.....	.7	1,000	100	10	.9	.0048	.005	3.5
Gallium....	.015	150,000	-----	-----	.0001	.0001	1.0	-----
Zirconium..	.93	+100,000	+100	1,000	.0013	.0065	5.0	-----
Molybdenum	.77	30,000	500	60	0.25	.0054	.2	2.0
Silver.....	.001	100	100	1	.006	.00003	.005	-----
Lead.....	1.3	1,000	40	50	1.0	.009	.009	2.5

¹ All tonnages in metric units.² Amount available in the nodules divided by the consumption rate.³ Calculated as the element in metric tons. (From U.S. Bureau of Mines Bulletin 556).⁴ Calculated as the element in metric tons.⁵ Present reserves so large as to be essentially unlimited at present rates of consumption.⁶ Including deposits of iron that are at present considered marginal.Source: Mero, *op. cit.*, p. 196.

VI. GOVERNMENT ACTIVITIES

Government involvement in deep ocean mining can be grouped into three major categories. The most common activities are: (1) direct sponsorship or funding of research and development; (2) direct venture in mining or processing; and (3) indirect sponsorship through use of government facilities, taxation advantages, or university aid.

UNITED STATES

Government activity in nodule research in the United States has been carried out by the Bureau of Mines, the U.S. Geological Survey, the National Oceanic and Atmospheric Administration (NOAA), the Naval Research Laboratory, and the National Science Foundation. Some of the research programs have been discussed previously. The research effort of the Bureau of Mines has involved recovery of metals from nodules. The interests of the U.S. Geological Survey in the deep seabed have been directed mainly toward assessing the mineral potential of nodule deposits and determining their composition and origin. Recently, on February 25, 1975, the Department of Interior announced the formation of an Ocean Mining Administration to develop plans for regulating U.S. ocean mining companies. The research funded by NOAA primarily involves environmental concerns. The Naval Research Laboratory is developing underwater photographic techniques and improved camera technology to provide greater capabilities for future exploration. The National Science Foundation is sponsoring participation by the United States in the International Decade of Ocean Exploration (IDOE). The funding for the IDOE ferromanganese nodule program is mainly being distributed to universities and institutions for research in nodule formation and chemistry.

FOREIGN GOVERNMENT ACTIVITIES

Several countries are actively interested or engaged in ferromanganese nodule mining. The following is a brief summary of activities reported in recent years.

AUSTRALIA

Australia's Bureau of Mineral Resources has been conducting research on manganese nodules. The naval vessel R/V *Diamantina* was used to dredge for nodules along a 200-mile stretch of the 39th parallel in June 1972.¹

FEDERAL REPUBLIC OF GERMANY

The government of the Federal Republic of Germany supported a joint venture of Preussag and Metallgesellschaft in 1969 to study and

¹ ECAFE, *Report of the Committee for Co-ordination of Joint Prospecting for Mineral Resources in South Pacific Off-shore Areas*. (CCOP/SOPAC), 1st session, November 1972 (E/CN.11/L.343), 1972, p. 34.

explore for manganese nodules. Preussag, Metallgesellschaft, Salzgit-ter and Rheinische Braunkohlenwerke formed Arbeitsgemeinschaft Meerestechnischgewinnbare Rohstoffe (AMR) to carry out exploration cruises in the Pacific under government subsidy. The West German government provided funds to charter Deepsea Venture's R/V *Prospector* in 1970 and 1971. Since private firms converted a stern trawler to the nodule exploration vessel, R/V *Valdivia*, in 1972, the West German Ministry for Education and Science has chartered the ship for four years to conduct a comprehensive nodule survey. Several cruises are planned in the nodule belt southeast of Hawaii. A sister ship is being built with government subsidies. The AMR group is also being subsidized for a nodule mining feasibility study.

FRANCE

The Centre National pour l'Exploitation des Océans (CNEOX) is sponsoring engineering research on a modified version of the CLB mining system. CNEOX in association with Société Le Nickel has also been engaged in extensive exploration for nodules in the South Pacific in the general vicinity of French Polynesia using the Tahiti-based research vessel *Le Norit*.² The French Atomic Energy Commission is conducting research on nodule processing techniques.

JAPAN

Government activity in Japan has been extensive in sponsoring nodule exploration and research and development of mining and metallurgical processing. The Industrial Science and Technology Agency subsidized Sumitomo Shoji and Sumitomo Shipbuilding and Machinery in 1968 to conduct tests of a small-scale CLB system. The Ministry of International Trade and Industry (MITI) has subsidized the Sumitomo group several times since 1970 to carry out research on and to develop, automatically detachable buckets for the CLB system. Sumitomo Metal Mining received a subsidy in 1972 to construct a test plant and conduct research and development on nodules processing. Government participation will increase with the recently proposed venture of government and industry. Thirty leading Japanese companies have formed a Deep Ocean Mining Association (DOMA) to advise MITI on the technology for mining and processing manganese nodules.³ Funds will be allocated by industry and government in 1976 or 1977. DOMA has a caretaker staff provided by Sumitomo Metal Mining. A sophisticated new mining vessel the *Hakurei Maru*, is ready to conduct nodule surveys and DOMA expects to begin commercial operations in 1980.

NEW ZEALAND

The Department of Scientific and Industrial Research is studying the distribution and chemical composition of manganese nodules and coatings.⁴

² CNEOX annual report, Paris, 1972.

³ *Metals Week*, June 11, 1973, p. 2.

⁴ ECAFE, *op. cit.*, p. 34

UNION OF SOVIET SOCIALIST REPUBLICS

The Soviet Union has been actively engaged in manganese nodule exploration and research since the 1950's. Large numbers of photos and samples of nodules have been obtained. Several technical papers have appeared in Soviet scientific journals over the years describing the mineralogy, chemistry, and internal structure of the nodules, their distribution, and hypotheses of origin.⁵ Earlier expeditions using the R/V *Vityaz*, were mainly concentrated in the Pacific and Indian Oceans while later investigations have extended into the Atlantic Ocean. In 1971, the Soviet bloc set up an International Coordinating Center of Marine Exploration in the Soviet Union.

Although the Soviets have dredged many nodule samples from the deep seabed for study purposes, there seems to be little progress toward commercial exploitation. One reason may be that the USSR is essentially self sufficient or a major exporter of the major metals contained in manganese nodules (nickel, copper, cobalt, and manganese). Consequently, developing expensive technology to recover these metals from the deep seabed would not be as pressing a concern to the USSR as it would be to other countries more dependent on imports of these metals.

On the Soviet shelf, low grade manganese nodules have been discovered in the Baltic Sea in the Gulf of Riga. In some areas of the shelf they are reported to exceed 3,500 tons per square kilometer.⁶

UNITED KINGDOM

The British Department of Trade and Industry has offered financial support to the two British members of the recently formed Kennecott group. The British firms are Rio Tinto Zinc Corp. and Consolidated Gold Fields Ltd. These firms would repay the loan if the venture is profitable, and would get first call on their 30 percent share of the metals produced.⁷

CANADA

Although several Canadian firms including International Nickel Company (INCO), Noranda Mines Ltd., and Cominco Ltd., are participants in international consortia to mine manganese nodules from the ocean floor, no government funds appear to be involved.

⁵ Skornyakova, N. S. and P. F. Andrusphchenko. Iron-manganese Nodules from the Central Part of the South Pacific. *Oceanology*, v. 8, n. 5, 1968, pp. 692-701.

⁶ *Sovetskaya Latvija*, November 24, 1968, p. 4.

⁷ *Metals Week*, Feb. 4, 1974, p. 6.

VII. LEGISLATIVE HISTORY

CONFRONTING THE ISSUES

On August 17, 1967, the Permanent Mission of Malta to the United Nations proposed in a *note verbale* that the 22nd U.N. General Assembly scheduled to convene the following month place on its agenda the following item:

Declaration and treaty concerning the reservation exclusively for peaceful purposes of the seabed and of the ocean floor, underlying the seas beyond the limits of present national jurisdiction, and the use of their resources in the interests of mankind.

The accompanying explanatory memorandum proposed that the seabed and ocean floor are a common heritage of mankind and the net financial benefits derived from the use and exploitation of the seabed and of the ocean floor shall be used primarily to promote the development of poor countries. The memorandum proposed that an international agency should be created to administer and control exploitation of the seabed beyond the limits of national jurisdiction.

Many countries saw this as a welcome opportunity to gain a share of an immense wealth if the technology could be developed to recover it. As the poorer countries were in no position to develop the expensive and sophisticated technology to exploit the seabed resources, this proposal to benefit directly from the ability of the technologically advanced nations had widespread support. The extent of this wealth was poorly defined, but the developing nations generally assumed that the seabed contained vast resources of oil and minerals that could help bring them to an economic par with the developed nations.

The sudden popularity of the Malta proposal was due to the timeliness of its presentation in the United Nations. The concept had been previously developed by the United States but had received little notice. In 1966, President Johnson said:

Under no circumstances, we believe, must we ever allow the prospect of rich harvest and mineral wealth to create a new form of colonial competition among the maritime nations. We must be careful to avoid a race to grab and to hold the lands under the high seas. We must insure that the deep seas and the ocean bottoms are, and remain, the legacy of all human beings.¹

LEGISLATIVE CONCERN IN THE 90TH CONGRESS

Although the U.S. delegation supported the Maltese proposal, the possibility of the United Nations taking immediate action to reserve the seabed beyond national jurisdiction for the common heritage of mankind aroused the concern of many members of Congress. Nearly two dozen resolutions were introduced into Congress during the months of August and September 1967 expressing opposition to the control of deep ocean resources by an international authority. Congressional endorsements of the Malta proposal were much less numerous.

¹ Speech given at the commissioning of the research ship *Oceanographer*, at the Washington Navy Yard on July 13, 1966.

In the House, most of the resolutions relating to this issue were referred to the Committee on Foreign Affairs and assigned to the Subcommittee on International Organizations and Movements. Hearings were held in September and October 1967 and jointly with the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries in June and July 1968.² Senate hearings were held by the Committee on Foreign Relations.³ There was generally more support for the Malta proposal in the Senate than in the House.

Opposition to U.N. action at this time arose from concern that seabed resources were too poorly known and the United States might be denying itself valuable assets. Delay was suggested pending the resolution of the entire question of the limits of national jurisdiction. In addition, some doubt was expressed whether the United Nations could effectively administer the vast area of the ocean floor.

Supporters suggested that the Malta proposal would lead to conservation of mineral resources, avoidance of possible conflicts arising from a wild scramble to claim and exploit the seabed, controls on marine pollution, reduced threat of military use of the seabed, independent income for the United Nations, and a general strengthening and maturity in the United Nations through experience gained in administering the ocean floor.

LEGISLATIVE CONCERN IN THE 91ST CONGRESS

Several committees in the 91st Congress examined issues related to the limits of the continental shelf and jurisdiction of the seabed resources beyond the shelf. The Senate Foreign Relations Subcommittee on Ocean Space, chaired by Senator Claiborne Pell, heard testimony on S. Res. 33. This Resolution, submitted by Senator Pell, proposed a set of basic principles governing activities of states in developing and exploiting the ocean space. The principles called for the use of the seabed and subsoil for peaceful purposes only, under licenses issued by authority of the United Nations; regulations on the disposal of radioactive waste material in the ocean; the establishment of a Sea Guard under the control of the U.N. Security Council; and a definition of the limits of the continental shelves.

Hearings were also held by the Special Study on United Nations Suboceanic Lands Policy of the Senate Committee on Commerce. This study group, chaired by Senator Ernest F. Hollings, was formed in July 1969 to consider "the policy which the United States should advocate within the United Nations when that organization considers the ground rules which should apply to those nations which desire to exploit the resources of the deep oceans."⁴

A third set of hearings was held by the Special Subcommittee on Outer Continental Shelf created by Senator Henry M. Jackson, chair-

² U.S. Congress. House. Committee on Foreign Affairs. The United Nations and the issue of deep ocean resources; interim report together with hearings. Held by the Subcommittee on International Organizations and Movements of the Committee on Foreign Affairs on H.J. Res. 816 and companion resolutions, Sept. 22, Oct. 10, 19, 25, and 31, 1967. 90th Cong., 1st sess., H. Rept. No. 999, Washington, D.C., U.S. Govt. Print. Off., 1967. 289 p.

³ U.S. Congress. Senate. Committee on Foreign Relations. Governing the use of ocean space. Hearings on S.J. Res. 111, S. Res. 172, and S. Res. 196. Held Nov. 29, 1967. 90th Cong., 1st sess., Washington, D.C., U.S. Govt. Print. Off., 1967. 71 p.

⁴ U.S. Congress. Senate. Committee on Commerce. Special Study on United Nations Suboceanic Lands Policy. Hearings held Sept. 23, 24, Oct. 3, and Nov. 21, 1969. 91st Cong., 1st sess., Washington, D.C., U.S. Govt. Print. Off., 1970.

man of the Committee on Interior and Insular Affairs. This Subcommittee chaired by Senator Lee Metcalf, began a comprehensive series of hearings in 1969 and 1970 to, as Senator Metcalf stated, "clarify and make more visible the issues related to the proper resolution of the questions associated with the development of a sound shelf and seabed resource policy."⁵ Following a closed session with members of the Executive agencies and the scientific community, the Special Subcommittee held several open hearings to consider legal issues, economic issues, industry reaction, views of interested citizens groups, testimony from Members of Congress, Administration policy, and the U.S. draft working paper to the U.N. Seabed Committee. These hearings were systematically analyzed and the findings and conclusions presented in the Subcommittee's report to the Committee on Interior and Insular Affairs.⁶

The Subcommittee adopted the wide-shelf position advanced by the American Bar Association, the National Petroleum Council, and the American Branch of the International Law Association. This interpretation of the 1958 Geneva Convention held that the definition of the seaward limits of the continental shelf contained in the Convention were sufficiently precise and required no amendment. Furthermore, reopening the Geneva Convention might be disadvantageous to the United States as Northcutt Ely, representing the American Bar Association, suggested, "All we know for sure is that a new law of the sea conference will be dominated by nations that have no interest in this subject except to take away from the coastal nations as much of the minerals of the continental margin as they can get."⁷ An American Bar Association report presented by Mr. Ely stated, "an agreement carried by a majority of small States might embody principles unacceptable to the United States, yet which would be difficult to disregard if formally adopted by such a conference."⁸

Although the Subcommittee on Outer Continental Shelf endorsed the general features of the President's ocean policy statement of May 1970 calling for a seabed treaty and an international authority, strong concern was voiced over the proposed renunciation of sovereign rights of all nations beyond the 200-meter isobath. The Subcommittee report stated:

Our only areas of initial difference with the President are his suggestions that the United States should renounce its sovereign rights to its continental margin in return for similar, but limited rights in an area designated as a trusteeship zone, and his suggestion that leases applying to areas of the continental shelf beyond the 200-meter isobath be issued subject to an international regime to be agreed upon * * *. To renounce what constitutes the heart of our sovereign rights in response to illegal demands by a handful of nations can only encourage greater violation of the freedom of the seas doctrine.⁹

With regard to the deep seabed, the Subcommittee concluded:

* * * we are nevertheless as concerned as he [the President] that the American people may derive their fair share of benefits from the exploration and ex-

⁵ U.S. Congress, Senate, Committee on Interior and Insular Affairs, Outer Continental Shelf. Hearings by Special Subcommittee on Outer Continental Shelf, Parts 1, 2, and 3, 1969 and 1970. 91st Cong., 1st and 2d sess., Washington, D.C., U.S. Govt. Print. Off., 1970.

⁶ U.S. Congress, Senate, Committee on Interior and Insular Affairs, Outer Continental Shelf. Report by the Special Subcommittee on Outer Continental Shelf. Dec. 21, 1970. Committee Print, U.S. Govt. Print. Off., 222 p.

⁷ *Ibid.*, p. 8.

⁸ *Ibid.*, p. 8.

⁹ *Ibid.*, p. 29, 30.

exploitation of the deep seabed beyond the limits of exclusive national jurisdiction. We share with the President the desire that such ocean resources be used rationally and equitably for the benefit of mankind. Rational and equitable use of deep seabed resources requires the establishment of conditions in any future seabed treaty which will encourage investment and insure protected access to those interested in, and capable of, responsibly undertaking mineral recovery operations.¹⁰

The President's policy statement formed the basis of the U.S. draft working paper presented to the U.N. Seabed Committee in August 1970. After reviewing the draft, the Subcommittee on Outer Continental Shelf expressed serious doubts about many of its provisions. Testimony at subsequent hearings highlighted many of these concerns. Mr. Northcutt Ely, representing the American Bar Association, stated:

It is manifest that in this proposed treaty we are characterizing as the "common heritage of mankind" resources that, under existing international law, are a major component of the American mineral estate, in which the United States has exclusive sovereign rights exercised by Congress * * *. The advantages to the United States visible within the four corners of this treaty are minimal.¹¹

Mr. John Laylin, representing the Committee on Oceanography of the Section on International and Comparative Law of the American Bar Association, agreed with the proposed licensing concept for exploitation but regarded the provision for licensing exploration as unworkable. He also maintained that the proposed regime was too elaborate and would be prohibitively expensive. Mr. Laylin suggested that the United States should license its own nationals and recognize the licenses of other countries during the interim period prior to the formation of an international authority, and that a future seabed treaty should preserve the integrity of investments made during the interim period.

Mr. T. S. Ary, Vice President of Union Carbide Exploration Corp., representing the American Mining Congress, presented several suggestions for technical improvements in the U.S. draft working paper. Among the points Mr. Ary raised was that there were far too many fees, rentals and bonuses in the working paper. He suggested a registration rather than a licensing system, and maintained that proprietary information from exploration should not be turned over to an international authority. Mr. Ary also suggested that the regime proposed in the working paper was too elaborate and did not provide a secure climate for investments made during the interim period. With regard to the interim period, Mr. Ary testified that U.S. industry was close to being capable of exploiting the sizable quantities of hard minerals on the seabeds beyond the continental margins, and that domestic legislation was needed. He indicated that such legislation, if adopted in substantially similar form by other nations, could, through the principle of international reciprocity, become the basis for common rules among nations regarding freedom of development and security of tenure among ocean miners. At that hearing, Senator Metcalf advised Mr. Ary that if the American Mining Congress would prepare legislation on this matter, he would introduce it for circulation and discussion.

The hearings also focused on the Moratorium Resolution of the U.N. General Assembly. In response to a letter from Senator Lee Met-

¹⁰ *Ibid.*, p. 31.

¹¹ *Ibid.*, p. 25.

calf questioning the position the State Department would anticipate toward U.S. nationals who express an intention to exploit minerals from the deep seabed, Mr. John R. Stevenson, Legal Advisor, Department of State replied:

The Department does not anticipate any efforts to discourage U.S. nationals from continuing with their current exploration plans. In the event that U.S. nationals should desire to engage in commercial exploitation prior to the establishment of an internationally agreed regime, we would seek to assure that their activities are conducted in accordance with relevant principles of international law, including the freedom of the seas and that the integrity of their investment receives due protection in any subsequent international agreement.¹²

Two of the major tasks the report of the Subcommittee on Outer Continental Shelf outlined for further development in the 92nd Congress were:

1. A continuing extensive review of the working paper introduced by the U.S. Delegation at the August 1970 session of the United Nations Seabed Committee with a view toward seeking modifications of it to conform to our interpretation of the President's intent and with our recommendations outlined above.

2. An investigation of the special problem of an interim policy which would insure continued exploration and exploitation of the natural resources of our continental margin under present law; and would establish appropriate protection for investments related to mineral recovery by U.S. nationals in areas of the deep seabed beyond the limits of exclusive national jurisdiction.¹³

LEGISLATIVE CONCERN IN THE 92D CONGRESS

The Special Subcommittee on Outer Continental Shelf went out of existence at the end of the 91st Congress but its Members continued to be concerned with deep seabed mineral exploitation. Pursuing the tasks outlined in the Subcommittee report, Senator Lee Metcalf asked Senator Henry M. Jackson, Chairman of the full committee to direct staff members to attend the July-August 1971 sessions of the United Nations Seabed Committee and to report their analysis and findings. Their report, *The Law of the Sea Crisis*,¹⁴ noted with concern that most developing nations generally favored some form of international seabed development monopoly and generally opposed the idea of a system of licensing or concessions advanced by developed countries.

The staff report also expressed the fear that the U.S. delegation was placing major emphasis on military objectives in negotiations, and sacrificing United States interests in seabed resources. The report stated:

We recognize that the U.S. free transit proposal was admittedly designed by the Defense Department to enhance U.S. military security. We are also aware of the committee's unfaltering support of the necessity of U.S. naval mobility. We call this fact to the attention of the Committee because we believe that the U.S. free transit proposal may be unattainable and because we fear that the Defense Department might urge the administration to abandon its deep seabed mining objectives and support the creation of an international seabed mining monopoly controlled by less developed nations as a trade-off for the votes of such less

¹² *Ibid.*, p. 23.

¹³ *Ibid.*, p. 33.

¹⁴ U.S. Congress. Senate. Committee on Interior and Insular Affairs. The law of the sea crisis. A staff report on the United Nations Seabed Committee, the outer continental shelf, and marine mineral development. 92d Cong., 1st sess., Committee print, December 1971, Washington, U.S. Govt. Print. Office, 1972, 328 p.

developed nations in favor of the Defense Department-sponsored free transit proposal.

To sacrifice U.S. mineral interests in mining the deep seabed for a perceived military objective is at least debatable; but to sacrifice U.S. mineral objectives in mining the deep seabed for what may be an unattainable military objective is folly, we feel.¹⁵

The staff report found a strong international trend for a wide shelf similar to the position taken by the former Special Subcommittee on Outer Continental Shelf. Most coastal nations favored a seaward extension of national jurisdiction to the outer edge of the submerged continental land mass or to 200 miles from shore, whichever is greater. Consequently, there seemed little prospect for adoption of the U.S. proposal for nations to renounce sovereign rights beyond the 200-meter depth contour.

The report recommended that the Senate Committee on Interior and Insular Affairs go forward with legislation to encourage U.S. nationals to proceed with the orderly development of seabed resources under the authority of the 1953 Outer Continental Shelf Lands Act. The report concluded:

Ample authority under well established law, enables the United States to regulate the activities of its nationals engaged in deep seabed mineral exploitation wherever upon the high seas they may be conducting such operations.¹⁶

On November 2, 1971, Senator Metcalf introduced the first deep seabed hard minerals bill, S. 2801. It was cosponsored by Senators Jackson, Allott, Bellmon, and Stevens. An identical bill, H.R. 13904, was introduced into the House on March 20 1972 by Representative Thomas N. Downing and 16 cosponsors. These bills which embodied the legislative recommendations of the U.S. mining interests, authorized the Secretary of the Interior to promote the conservation and orderly development of the hard mineral resources of the deep seabed, pending adoption of an international regime.

Shortly before hearings on these bills were scheduled, observers were sent to the March 1972 session of the U.N. Seabed Committee. Their report¹⁷ warned of the militant stand toward U.S. rights to mine the ocean floor taken by the "Group of 77," the policy caucus of now more than 100 developing countries of Africa, Asia, and Latin America. The delegate from Chile contended that present seabed exploration and development activities of U.S. companies violated international law. He called for a cessation of such activities by the United States and other countries and urged the U.N. Secretariat to investigate U.S. ocean mining activities and requested the U.S. delegation to provide the Secretariat with all evidence of seabed mining activities of its nationals. The Chilean delegate also attacked S. 2801 by suggesting that, if enacted, it would establish a policy contrary to international law.

The delegate from Peru endorsed these remarks and threatened the United States and other developed countries with U.N. sanctions unless they assured the Seabed Committee that there would be no further seabed mining development.

¹⁵ *Ibid.*, p. 10.

¹⁶ *Ibid.*, p. 10.

¹⁷ U.S. Congress. Senate. Committee on Interior and Insular Affairs. Law of the sea crisis: an intensifying polarization. Part II. A Staff Report on the United Nations Seabed Committee, the Outer Continental Shelf and Marine Mineral Development. May 1972. Washington, U.S. Govt. Print. Off., 1972, 147 p.

The U.S. delegation responded to these charges by stating that U.S. companies were engaged in manganese nodule exploration activities as they have the implied right to do. Furthermore, the sooner such minerals are recovered the sooner mankind will benefit from these resources. The activities of U.S. companies, the U.S. delegate stressed, only emphasize the importance of reaching an international agreement for a seabed regime.

Senators Metcalf and Bellmon also responded to this attack on legislation before the U.S. Congress. Senator Metcalf stated:

We would be most interested to consider their objective analysis of S. 2801 and the relationship between it and the development of a future seabed treaty. But mere threats, claims and demands such as were made at the U.N. last week and made during the debate preceding the adoption of the now defunct Moratorium Resolution will do little to influence us during our consideration of national legislation affecting U.S. nationals.¹⁸

Hearings on H.R. 13904 were held by the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries on May 12, 16, and 25, 1972.¹⁹ Hearings on S. 2801 were held on June 2, 1972 by the Subcommittee on Minerals, Materials and Fuels of the Senate Committee on Interior and Insular Affairs.²⁰ Seabed resources were also included in hearings on law of the sea issues by the Subcommittee on International Organizations and Movements of the House Committee on Foreign Affairs,²¹ the Subcommittee on Oceans and Atmosphere of the Senate Committee on Commerce,²² and the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries.²³

Several issues emerged during the hearings on S. 2801 and H.R. 13904, but neither bill was reported out of committee. The major issues developed were as follows:

1. How long will it take to arrive at an internationally agreed-upon settlement to the numerous legal/political problems of resource jurisdiction and a seabed regime?
2. What are the technological considerations and what harm will be done to the American mining industries if they were forced to wait and lose their present technological lead?
3. What correlation is there between the interim legislation and stated U.S. ocean policy and resolutions adopted by the United Nations?
4. What will be the economic impact of mining seabed nodules on developing countries or on the United States?

¹⁸ Metcalf, Lee. Statement by Senator Metcalf. In Remarks of Henry Bellmon. Congressional Record (daily ed.) v. 118, Mar. 14, 1972, p. S 3929.

¹⁹ U.S. Congress. House. Committee on Merchant Marine and Fisheries. Oceanography miscellaneous. Hearings before the Subcommittee on Oceanography on Deep Seabed Hard Mineral Resources. NACOA Authorization, and Geneva U.N. Seabed Committee, 92d Cong., 2d sess. May 12, 16, 25, and Sept. 14, 26, 1972. Washington, U.S. Govt. Print. Off., 1972, 273 p.

²⁰ U.S. Congress. Senate. Committee on Interior and Insular Affairs. Development of hard mineral resources of the deep seabed. Hearing before the Subcommittee on Minerals, Materials and Fuels on S. 2801. 92d Cong., 2d sess. June 2, 1972. Washington, U.S. Govt. Print. Off., 1972, 77 p.

²¹ U.S. Congress. House. Committee on Foreign Affairs. Law of the sea and peaceful uses of the seabeds. Hearings before the Subcommittee on International Organizations and Movements. 92d Cong., 2d sess., Apr. 10 and 11, 1972. Washington, U.S. Govt. Print. Off., 1972, 115 p.

²² U.S. Congress. Senate. Committee on Commerce. Law of the sea. Hearing before the Subcommittee on Oceans and Atmosphere. 92d Cong., 2d sess., Oct. 3, 1972. Washington, U.S. Govt. Print. Off., 1972, 137 p.

²³ Oceanography Miscellaneous, *op. cit.*, pp. 237-273.

5. What implications will the interim legislation have on U.S. foreign policy, balance of payments, and foreign aid?

6. How will the legislation affect the environment or interfere with other marine activities?

The hearings revealed opposition to the proposed legislation by internationally oriented groups and individuals, including several lawyers, a geologist, and a group called *Save Our Seas*. Legal and business representatives of both the petroleum and mining industries strongly supported the interim legislation. Some Members of Congress testified in favor and some opposed.

The Executive branch maintained that the United States wished to delay taking a specific position on S. 2801 and H.R. 13904. In a letter to Senator Henry M. Jackson, dated May 19, 1972, John Stevenson, head of the Interagency Task Force on Law of the Sea and Legal Advisor to the State Department, explained:

We are not prepared at this time to state a position on S. 2801. We realize, however, that we cannot indefinitely postpone doing so on legislation of this type and we will watch the developments in the summer session of the U.N. Seabeds Committee and the U.N. General Assembly session this fall very closely * * *. We will report to you again on this matter in the fall.²⁴

In the fall hearings, the State Department was still not prepared to take a position on S. 2801, citing as a reason prospects for progress in the continuing negotiations in the U.N. General Assembly.

Proponents of the interim legislation cited the investment of several million dollars by U.S. mining companies to develop seabed mining technology over the last 10 years. They warned that this technological lead might be lost to foreign competitors if U.S. firms are not encouraged to proceed to commercial production. American mining interests stated they were hesitant to invest the additional sums of \$150 to \$300 million necessary to reach commercial production without some security for their mining claims. N. W. Freeman, Chairman of the Board of Tenneco, Inc., of which Deepsea Ventures is a subsidiary, outlined the following considerations restraining further funding of major operations:

1. Detailed definition of any one of Deepsea's ore body discoveries will entail extensive, costly, and highly visible operations on location, as will future on-site engineering tests. The location of the ore body will inevitably become public information when these operations begin.

2. The ore bodies Deepsea has located which are of economic interest tend to be limited in area due to local phenomena including topography, concentration, and assay. Candidacy is judged by the requirements of a 40-year operation at one million short tons of dry nodules recovered per year.

3. The candidate ore bodies differ significantly in bearing strength of the seabed, depth, current and weather conditions, distance from support bases, and assay, composition, size, weight, and concentration of the nodule population. All of these phenomena significantly affect engineering designs, which must be tailored *as early as possible* to the particular ore body selected. For example, two ore bodies of equal economic value might, according to Deep-

²⁴ Development of Hard Mineral Resources of the Deep Seabed, *op. cit.*, p. 7.

sea's experience and technology, require quite different processing plant equipment. The processing plant constitutes the largest single capital cost of the Deepsea ocean mining project.

4. National and international monitoring of environmental impacts, if any, will require inspections during test and development operations thereby making compulsory disclosure of mine site location likely.

Therefore, the extensive costs associated with the particular mine site *must* be protected by a preferential right to the selected ore body and that preferential right *must* vest prior to the time:

- (a) The mine site location is compromised,
- (b) The engineering design is finalized, and
- (c) The construction costs are incurred.²⁵

Another point made by the mining interests was the domestic need for the metals contained in the manganese nodules and our increasing dependence on foreign sources of supply. C. H. Burgess, Vice President, Exploration, Kennecott Copper Corp., cited the April 1972 interim report of the National Commission on Materials Policy entitled, "Toward a National Mineral Policy—Basic Data and Issues", which stated:

That as the nation's needs continue to grow, as per capita consumption of materials in other countries increases at an even faster rate than ours, it becomes increasingly difficult for the U.S. to fill its evergrowing deficits by imports, even at increasing prices.²⁶

Mr. Burgess also pointed out that in 1970 the United States imported almost \$400 million of nickel, about \$600 million of copper, and \$35 million of manganese.

The threat of losing not only the technological lead to foreign countries but also the products of commercial seabed operations was also revealed in the following exchange between Senator Metcalf and Jack Flipse, President of Deepsea Ventures:

MR. METCALF. In your opinion would these foreign countries, some of which have already been outlined by previous witnesses, would they wait until ratification of an international treaty or a United Nations-sponsored regime?

MR. FLIPSE. It is my conviction that they would not, inasmuch as their expenditures in the area raises from a maximum of 25 percent of the cost to a minimum of no cost. It is this underwriting or subsidy in the foreign area which permits them to move ahead with much less regard for a stable political environment.²⁷

Supporters of the bills pointed to the need for interim legislation because of the likely delays in obtaining a new Law of the Sea Convention. They cited the eight years spent in preparation for the 1958 Geneva Conventions that codified customary maritime law and suggested that an even longer period might be needed before a new international treaty involving unprecedented legal issues would go into effect. They also suggested that the legislation might induce delegations to get down to business in the U.N. Seabed Committee and make progress in negotiations.

Opponents of the legislation expressed the fear that unilateral action by the United States would destroy any hope for successfully negotiat-

²⁵ *Ibid.*, p. 73.

²⁶ *Ibid.*, p. 35.

²⁷ *Ibid.*, p. 43.

ing a seabed treaty, and would instead initiate a universal grab for distant offshore claims. They pointed out that S. 2801 and H.R. 13904 are directly opposed to the stated position of the President and the U.S. delegation to the U.N. Seabed Committee. Furthermore, while the U.N. Declaration of Principles and the Moratorium Resolution are not legally binding on any nation, they convey recommendations to governments with the expectation that U.N. members will abide by them. Opponents were concerned that the provisions of S. 2801 would be characterized as an attempt by the United States unilaterally to claim national jurisdiction over areas of the deep ocean bottom beyond the limits of U.S. national jurisdiction.

Another point raised in opposition to licensing U.S. nationals to develop seabed mining operations was inadequate consideration for the ocean environment. Senator Alan Cranston described the lack of environmental regulation as one of the most important flaws in the bill and stated, "S. 2801 fails to establish procedures by which damages for environmental pollution could be assessed peacefully and fairly."²⁸

Lack of environmental data was also cited as a reason for delaying action on the bills. However, preliminary studies were introduced indicating the mining method developed by Deepsea Ventures produced no significant environmental effects. These studies were conducted in the summer of 1970 by scientists of the Lamont-Doherty Geological Observatory in 800 meters of water on the Blake Plateau in the Atlantic. Dr. Oswald A. Roels, the principal investigator, stated that under the conditions employed, the discharged water remained in the euphotic zone; was not likely to produce anoxic conditions; and would increase phytoplankton growth (which could lead to increased marine food chain productivity) only if its concentration, after mixing with surface water, exceeded 10 percent, which it did not. Dr. Roels also outlined a program for future research to further assess the environmental impact of seabed mining.

Among the specific objections raised to S. 2801 and H.R. 13904, Samuel R. Levering of *Save Our Seas* stated:

1. The size of the blocks (40,000 square kilometers) is too large. 5,000 kilometers should be enough.
2. Total holdings by one licensee of about 400,000 square kilometers within a circle with a diameter of 1250 kilometers again is much too large. This might yield forty times the current annual consumption of nickel. Full implementation of this provision soon might substantially exhaust the possibilities for commercial exploitation of the best nodule sites.
3. The principle of exclusive occupancy is unnecessary. What is needed is exclusive access for harvesting nodules from the ocean floor by moving machinery.
4. No provision is needed now for subsurface mining. Present provision should be limited to operation on or immediately below the deep ocean floor.
5. The license should be to exploit a certain number of tons of nodules over a certain limited number of years (for example, 20 years), not into the far distant future.²⁹

Mr. Levering also suggested that negotiations with other nations leading to mutual restraint is a better way to prevent others from "getting ahead" of the United States.

Mr. Frank L. LaQue, former Vice President of International Nickel Co., also criticized the large size of the licensed blocks and suggested licensing only rights to access to specified quantities of nodules within a

²⁸ *Ibid.*, pp. 20-21.

²⁹ *Ibid.*, p. 70.

defined time period. Mr. LaQue recommended that only manganese nodules be considered in any proposed legislation and metalliferous muds or subsurface hard minerals should not be included. In addition, he doubted the likelihood that other "reciprocating states" would be willing to have the terms of their reciprocation dictated by the United States through the mechanism of S. 2801. Consequently, he doubted the real value of the security that the bill is supposed to provide.

An issue that had become a political focal point in the United Nations was also addressed in the hearings. This was the question as to the extent of the economic impact on the mineral exporting developing countries who would be adversely affected by seabed mining. Studies by the United Nations were submitted indicating:

A possible adverse impact on these [metals] markets would not be catastrophically disruptive to the economies of the countries concerned. Nevertheless, any loss, current or potential, of export revenues to developing countries creates additional problems to their already strained economies in the process of development.³⁰

Several means were proposed for diminishing the impact of seabed mining on the land-based mining industries in developing countries:

1. Artificial control of production from the seabed to keep it at levels that would not interfere with land production or prices;
2. Global controls, which would not discriminate against seabed production, for they would presumably apply to producers irrespective of the location of their mines;
3. Limitation on the issuances of exploitation licenses to a rate judged appropriate to maintain a balance between land and sea production;
4. Issue a license for a specified amount of annual production of metal and to limit the number of such licenses to that necessary for market and price stability;
5. Impose a drop in price at the expense of producing countries;
6. Compensatory payments by the international machinery to the countries affected by the declines in export revenues; and
7. Providing preferential technical assistance to developing countries adversely affected by seabed production to help them broaden their economic base.

LEGISLATIVE CONCERN IN THE 93D CONGRESS

During the 93d Congress, the issue of deep seabed hard minerals exploitation took several turns. The interplay between the deliberations of the Congressional Committees and the negotiations in the U.N. Seabed Committee became more intensified. As a result of developments in the Seabed Committee and testimony before the Congressional Committees, sponsors of the legislation introduced several changes in the bills during the second session.

THE FIRST SESSION

The Deep Seabed Hard Minerals Resources Act was reintroduced into the 93d Congress as H.R. 9 on January 3, 1973 by Representative Thomas N. Downing, and the identical companion bill, S. 1134,

³⁰ U.N. General Assembly. Possible impact of seabed mineral production in the area beyond national jurisdiction on world markets, with special reference to the problems of developing countries: a preliminary assessment. A/AC.138/36. May 28, 1971. p. 65.

on March 8, 1973 by Senator Lee Metcalf. The House held hearings on March 1, 28, 29, and April 3, 1973.³¹ The Senate hearings were held May 17, June 14, 15, 18, and 19, 1973.³² In their testimonies, most of the interest groups maintained much the same positions as taken in the previous Congress. However, in contrast to the hearings in the 92d Congress in which the Administration witnesses did not take a position on the legislation, Mr. Charles N. Brower, Acting Legal Advisor and Acting Chairman of the Inter-Agency Task Force on the Law of the Sea, in letters dated March 1, 1973, informed Representative Leonor K. Sullivan, Chairman of the House Merchant Marine and Fisheries Committee and Senator Henry M. Jackson, Chairman, Committee on Interior and Insular Affairs, of the Administration's opposition to H.R. 9 (Appendix A). Mr. Brower maintained that H.R. 9 was premature and that the Administration adhered to the policy contained in the President's Ocean Policy Statement of May 23, 1970, in which the President proposed that all nations adopt, as soon as possible, a treaty establishing an international regime for the exploitation of seabed resources beyond the 200 meter depth.

In addition, he reiterated the President's statement that it was neither necessary nor desirable to try to halt exploration and exploitation of the seabeds during the negotiation process, provided that such activities are subject to the international regime to be agreed upon, which should include due protection of the integrity of investments made in the interim period.

Mr. Brower expressed the belief that with the Law of the Sea negotiations moving into a critical stage, it is necessary for States to be very careful to avoid actions that can have an adverse effect on the negotiating atmosphere. He further stated:

It is apparent that H.R. 9 independent of the particular content or merits of the Bill, has become a symbol to many countries of defiance of the multilateral negotiating process. Regardless of our views on the intent and effect of the legislation, it may be argued by others that the legislation is similar to unilateral claims that we oppose and that are contrary to our security, navigation and resource interests, and moreover preempts the Law of the Sea Conference on this issue.³³

Finally, he stated that while the Administration intended to begin at once to formulate a legislative approach on a contingency basis, the Administration did not seek the passage of alternative legislation prior to the conclusion of the Conference, if a timely and successful Conference were predictable. He defined a "timely and successful Conference" to mean a Conference which would arrive at a Convention, including a seabed regime, which would be open for signature in 1974 or, at the latest, not later than the summer of 1975.

On the other hand, some sponsors of the legislation began to take a less optimistic view of progress in the United Nations. In commenting on the endless and seemingly unproductive negotiating sessions of the U.N. Seabeds Committee, Congressman Downing, Chairman of

³¹ U.S. Congress. House. Committee on Merchant Marine and Fisheries. Deep seabed hard minerals. Hearings before the Subcommittee on Oceanography on H.R. 9 and H.R. 7732. 93d Cong. Mar. 1, 28, 29 Apr. 3, 1973, and H.R. 12233 Feb. 26, 27, 28, 1974. Washington, D.C., U.S. Govt. Print. Off., 1974, 513 p.

³² U.S. Congress. Senate. Committee on Interior and Insular Affairs. Mineral resources of the deep seabed. Hearings before the Subcommittee on Minerals, Materials and Fuels on S. 1134. 93d Cong., 1st sess. May 17, June 14, 15, 18, and 19, 1973. Washington, D.C., U.S. Govt. Print. Off., 1973, 768 p.

³³ Appendix A.

the Subcommittee on Oceanography, House Committee on Merchant Marine and Fisheries stated:

Since the committee first addressed itself to this interim legislation, the international negotiations, which have so long dominated administration policy on marine resources, have seemingly receded even farther into the future. Little was accomplished in 1972 negotiations except the production of a conference agenda of doubtful content and a few items of proposed treaty "language" of somewhat dubious utility. The nature of these items, and particularly the last minute timing of their production, may easily lead one to believe that their accomplishment is more cosmetic than substantive in intent and effect.

The 1973 Conference on Law of the Sea has now become the 1974-75 Conference to be preceded by a short organizational exercise in late 1973.

The Seabed Committee, sitting for 2 years as a conference preparatory committee, after a previous 3 years of general debate, has not produced even a minimum amount of proposed treaty language upon which to structure negotiation in the Conference. It only has some 65 scheduled days in 1973 to do so. If it cannot, and I believe that it cannot, the November-December 1973 United Nations General Assembly has the authority and responsibility to delay Conference plans for another year or more.

In the face of continual delay and disruption at the U.N., domestic interests continue to suffer disadvantage and administration neglect * * *. Our ocean miners are frustrated in their plans to develop highly desirable alternate metal sources because investment capital is difficult to secure in a politically emotional legal atmosphere. * * *

These miners are now ready to make substantial investments leading to actual mining operations. This investment must not be inhibited by the irresponsible actions of materials-exporting countries using the U.N. as a mechanism to prevent the United States from developing alternative sources of copper and other critical metals.

It is time for the United States to protect its national interest and to reaffirm strongly its commitment to the principle that deep ocean resources should remain available to all nations and should not become the monopolized resource of any one entity—private, public, or international. * * *

This legislation has a potentially beneficial effect on domestic revenue, balance of payments, materials availabilities, ocean technology, and many other facets which may very well outweigh considerations related to our international relationships.³⁴

The State Department response to Senator Jackson and Representative Sullivan was also conveyed to delegates in the U.N. Seabed Committee by the head of the U.S. delegation, Mr. John Norton Moore. He informed the other delegations that the Executive Branch opposed the passage of U.S. seabed legislation at this time although they could not rule out the alternative of interim legislation if a Law of the Sea Conference is not concluded as scheduled and does not produce a treaty that assures an accommodation of the basic objectives of all nations. He pointed out that the Administration was keenly aware of the lack of confidence many people have in the timely and satisfactory progress of the U.N. Seabed Committee and the need of U.S. companies to secure a more stable base for seabed investments. Using these points as leverage, Mr. Moore pressed the Seabed Committee to maintain its schedule. He also stressed the need to prepare for the provisional entry into force of an internationally agreed regime immediately after a law of the sea treaty is opened for signature. He suggested that this would be necessary to ensure that all seabed exploitation is covered from the beginning by the treaty "so that states will not have to consider other alternatives to resolve the problem."

This proposal to the U.N. Seabed Committee for an interim regime was then reported to the House Subcommittee on Oceanography in

³⁴ Deep Seabed Hard Minerals, *op. cit.*, pp. 11, 12, 13.

the March 28 hearing. In the June 14 hearing of the Senate Subcommittee on Minerals, Materials and Fuels, Mr. Moore reported on the favorable response to the U.S. proposal. He stated that of the 20 delegations which spoke to the proposal no delegation opposed the concept. This response was cited as an example of satisfactory progress in difficult negotiations.

In response to Senator Metcalf, Mr. Moore then amplified the Administration's position that passage of legislation for seabed hard mineral mining would not be advisable from the standpoint of the Law of the Sea negotiations even if it were not to become effective until January 1, 1976. He repeated the premise that such action would be viewed by many delegations as a thinly veiled threat of unilateral action by the United States to pressure others into an agreement on our terms.

Senator Metcalf still maintained a neutral stance in his sponsorship of S. 1134. In his opening remarks in the May 17, 1973 hearings, Senator Metcalf stated:

I emphasize that my sponsorship of S. 1134 does not imply my support of all of its provisions. The predecessor bill grew out of the appearance by representatives of the American Mining Congress before my special subcommittee on the Outer Continental Shelf in September of 1970. At that time, as our hearing records will show, I told industry witnesses that I would introduce their proposals for circulation and discussion. That was my position when I introduced S. 2801. It is my position today. I am not committed to this particular bill nor to any part of it. But I, and the members of this subcommittee are ready to be convinced.³⁵

Among the supporters of the proposed legislation was Mr. T. S. Ary, vice president of Union Carbide Exploration Corporation, and representative of the American Mining Congress. He pointed out the balance-of-payments deficit for primary minerals would reach \$64 billion by the year 2000 assuming only 1970 prices. He suggested that encouraging investment in nodule mining would lead to technological breakthroughs which would carry over into other aspects of U.S. industry. He also expressed the fear that by delaying seabed mineral recovery, the United States would lose its technological lead and competitive advantages.

In defending specific points in the legislation, Mr. Ary testified that the lease payment was not too small. He stated:

We feel that the amount of money is fair, the risk is great and during the exploration stage the risk is being assumed by the company. If the amount of money is too low you will have a speculative group come into the operation. In our discussions we have suggested that a nominal amount be required for the exploration license but that work requirements involved be of a substantial nature so you do not sit on the blocks.³⁶

Mr. Ary conceded that the ocean mining industry would only need mining areas beyond the continental rise so that any redefinition of the deep seabed in the bill to avoid conflict with discussions over boundaries of national jurisdiction would be acceptable. He also had no objection to deleting the concept of subsurface blocks because there is no present need to regulate these.

Mr. Edwin M. Hood, President and Board Chairman, Shipbuilders Council of America spoke to the need of the shipbuilding industry for assured availability of the metals contained in manganese nodules. He

³⁵ Mineral Resources of the Deep Seabed. *op. cit.*, p. 81.

³⁶ Deep Seabed Hard Minerals, *op. cit.*, p. 284.

also stressed the beneficial impact construction of nodule mining ships and ore carriers would have on the U.S. shipbuilding industry.

In testimony before the Subcommittee on Minerals, Materials and Fuels, Dr. Richard A. Geyer, head of the Department of Oceanography, Texas A. & M. University and former vice chairman of the Stratton Commission, urged passage of S. 1134. He discounted the possible environmental damage from ocean mining as being insignificant compared to that caused by naturally occurring large-scale oceanographic phenomena such as turbidity currents and natural upwelling. Dr. Geyer concluded:

After studying the provisions of this bill, I am convinced that it represents an excellent vehicle to implement most effectively a number of those recommendations of the Commission on Marine Science, Engineering, and Resources—more commonly known as the Stratton Commission—directed toward the development of ocean mining in general and manganese mining in particular.³⁷

In testimony before the House Subcommittee on Oceanography, John E. Flipse, President of Deepsea Ventures, Inc., discussed several points which had been questioned by Committee members. He explained that the minesite size of 10,000 square kilometers for the purposes of exploitation is barely adequate for a mining operation scaled to the recovery of one million tons of dry nodules per year, assuming the nodule concentration of about two pounds per square foot and a recovery efficiency within the present capability of technology. He stated:

Realistic estimates of dredging accessibility and efficiency, sweep efficiency, and the cut off grade of actual minesites indicate an overall mining recovery efficiency of well below 50 percent of the nodules on the minesite. * * * Our calculations indicate that a 1 million ton operation is the minimum efficient size to take advantage of existing economies of scale and engineering efficiency.³⁸

Mr. Flipse pointed out that while the work requirements during the exploration or development period are minimal in the scale of real costs to be incurred in ocean mining development, they are considered by industry sufficient to preclude speculative paper-claim filing but small enough to allow minimum-size operations to meet the legislative requirements. Mr. Flipse also acknowledged that the investment guarantee period of 40 years may be excessive. He stated:

I think 40 years was chosen originally because, based upon Internal Revenue Code, financial commitments were going to be written off on pier facilities, buildings, main plant facilities, over a 40-year period. This was the basis for this number being selected for the guarantee. I feel that some of us are ready to accept a lesser period although the drafters and the Mining Congress still feel that the 40 years is a reasonable time period, based upon the durability of a fair proportion of this equipment.³⁹

Mr. Flipse also informed the Subcommittee that based on Deepsea Ventures' determinations, 20 to 30 percent of the deep ocean floor has economically developable deposits. He stated that it would take approximately 5 years from the day the bill is passed before processed metals reached the market. Furthermore, in 5 years or more if an international regime went into effect, his company would have recovered only a fraction of a thousandth of a percent of the economic deposits.

Among the opponents of the legislation was Mr. Leigh Ratiner, former Director, Office of Ocean Resources, Department of the Inte-

³⁷ Mineral Resources of the Deep Seabed, *op. cit.*, p. 336.

³⁸ Deep Seabed Hard Minerals, *op. cit.*, p. 87.

³⁹ *Ibid.*, p. 89.

rior. He raised the objection of getting locked into a specific resource management scheme which details block sizes, tenure, work requirements, fees, royalties, and so forth. Mr. Ratiner stated the problem as follows:

We would need to assemble a large data base of information about the technology, the metallurgy, and the costs of doing business in order to establish any degree of real precision for the purpose of legislation, which has a tendency to endure, sometimes even beyond the point when the information it was based on was still credible and still up to date. We would want to be very sure we had adequate data. For the moment it is fair to say that we do not have adequate data.⁴⁰

Mr. Ratiner also pointed out that industry is virtually the sole source of this information, the U.S. Geological Survey has neither the funds nor the capability to do the kind of oceanwide survey which would be required in order to have first-hand knowledge and information.

Mr. Ratiner questioned the immediate necessity of passing interim legislation. Based on 1971 data, he pointed out, the United States spent \$600 million importing metals contained in manganese nodules and that amounted to 1.3 percent of our total import. He recognized that this is likely to increase but felt that a delay of a year or two to await a provisional U.N. regime would not greatly affect our balance-of-payments situation.

Mr. Marne A. Dubs, representing the American Mining Congress exposed the other side of the deficient data argument. He stated that if full-scale mining were to begin during the interim period before an international treaty is concluded sound technical information could be gathered to help create sensible regulations in the future regime. "Hard information," he said, "can only come from a successful full-scale mining operation which in turn requires this legislation in order to commence."⁴¹

Mr. Dubs also expressed reservations about the value of the State Department's proposal to the U.N. Seabed Committee for a provisional regime. He stated:

One problem with the provisional regime is that it might have far less than universal acceptance. This might create serious problems for an organization operating under its umbrella. It also should be noted that it is unlikely that the details of such a provisional regime could be worked out and put into force any earlier than a year after conclusion of the convention.⁴²

The hearings of the Senate Subcommittee on Minerals, Materials and Fuels on June 18, 1973 were scheduled to hear spokesmen for the environmental groups. In his opening statement, Senator Metcalf remarked:

You will recall that when I was chairman of the Special Subcommittee on the Outer Continental Shelf we scheduled a hearing for May 13, 1970, to hear witnesses representing the interests of what was then called "conservation." That was before conservationists became environmentalists.

We had no witnesses, but statements were submitted by, among others: Charles H. Callison, executive vice president of the National Audubon Society; Thomas L. Kimball, executive director of the National Wildlife Federation, and Richard H. Stroud, executive vice president of the Sport Fishing Institute.

I am glad to know that in the intervening 3 years the environmentalists have been able to turn their attention to this complex subject.

When mining industry witnesses appeared before this subcommittee last month, I asked them a series of questions about environmental protection. You were

⁴⁰ Mineral Resources of the Deep Seabed, *op. cit.*, p. 236.

⁴¹ *Ibid.*, p. 114.

⁴² *Ibid.*, p. 119.

furnished with copies of the replies. These included the allegation that the area to be mined is "biologically barren" and that "the impact of deepsea nodule mining on biological processes will probably be minimal".

I also hope that you have statistics or studies to back up your statements and that you will share them with this committee, which shares your concern about our environment.

And, of course, should you have suggestions for amendments to this bill, or legislative proposals of your own, we want them.⁴³

Mr. Carl R. Sullivan, Executive Secretary of the Sport Fishing Institute, thought that the bill was too broad and that it should be narrowed somewhat to preclude any type of mining that might involve blasting or exposure of toxic materials under the seabed. He also suggested that, although it does not appear likely to occur, any ship-board processing would require a special set of environmental considerations and careful monitoring to prevent the discharge of toxic chemicals into the sea. He further stated:

Nowhere in this bill does it mention where the processing of the ore will be done. I think again there might be financial incentives to have it done in a so-called "developing nation" that had environmental constraints much less stringent than ours, where they can save money by avoiding some of the pitfalls that might be required on U.S. soil.

We believe it should be stated and we believe that the processing of the ore—unless there are compelling political reasons—should be done on U.S. soil someplace.⁴⁴

Mrs. Nancy Matisoff, speaking for the Izaak Walton League of America, informed the Subcommittee that one of the primary concerns of their organization is the lack of definitive and comprehensive data of the effects of deep sea mining operations on surface and bottom life. She suggested that the present bill was seriously deficient in its treatment of the need for ocean and technological research and called for a full-scale research program in this area.

Speaking for several environmental groups including the Sierra Club and the Environmental Defense Fund, Mr. Richard Frank of the Center for Law and Social Policy objected to the proposed legislation for two reasons. First, he believed passage of the bill would jeopardize the possibility of effective international agreement on preserving the quality of the ocean environment. Second, he maintained that no action should be taken until a comprehensive environmental impact statement is prepared by the Executive Branch.

Dr. John J. Logue, Director, World Order Research Institute, Villanova University, testifying on behalf of World Federalists, U.S.A., suggested that the \$5,000 long-term leasing fee to mine 40,000 square kilometers of ocean floor is far too low. Furthermore, he argued that the U.S. government does not, in his opinion, have the authority to grant such leases. He also suggested that passage of the Deep Seabed Bill would impede future ratification of a seabed treaty by the Senate because of the possibility of then having to pay \$400 to \$500 million compensation to our own mining companies.

Professor L. F. E. Goldie, Director, International Legal Studies Program, Syracuse University College of Law, took exception to some of Dr. Logue's comments and pointed out that U.S. citizens as well as anyone else have the right to the common heritage of mankind. He said:

⁴³ *Ibid.*, pp. 305, 306.

⁴⁴ *Ibid.*, p. 310.

We citizens of the United States, I will remind many people, are also mankind. They [the high seas beyond national jurisdiction] are part of our common property and we are entitled to exercise our individual rights to the common resources. We can graze our cows. We can take our water from the common wells just like any other common holder of common rights.⁴⁵

Professor Goldie also suggested that the escrow section of the bill be strengthened to include not only developing countries who participate in their regimes, but all countries. Professor Goldie further stated:

I would like to point out that technology is exportable. It is salable. I see no reason why Monaco could not apply, let us say, the technology of deep sea mining or Luxembourg, provided they can reach some kind of an agreement for that kind of purchase. Or let us step outside of Europe altogether. There are countries who no doubt could through the World Bank assistance purchase the technology that we have developed or other countries have developed and engage in deep sea mining. It is not simply a matter of a closed club of the so-called northern developed countries.⁴⁶

In the conclusion of a paper submitted for the record, Professor Goldie summarized the legality and filing procedure for deep seabed mining claims. In the paper he stated:

Independently of Congress's enactment of the *Deep Seabed Hard Minerals Act*, enterprises may prove and develop mining tracts on the deep seabed of a reasonable size. Translating "reasonable" into factual claims would depend on a number of criteria including the nature of the resources to be won and their distribution, equitable considerations of other claims to win the same resource, and what could be considered as within the scope of a possessory intent and control on part of the enterprise. These rights are not subject to impairment through any disparagements advanced under the United Nations Assembly's 1969 Moratorium Resolution or 1970 Declaration of Legal Principles.

Deep seabed mining claims should be recorded by filing with the Foreign Office of a claimant's country of nationality all documents necessary to show title. These should include a Deed Poll announcing to the world the recording enterprise's claim, a surveyor or navigator's description of the tract in terms of fixes, bearings and distances, evidence of possession and of continued active exploitation of the resource, an intent to assert exclusive rights to exploit the mineral resources of the tract and testimony that the enterprise was "first in time". These specific acts reflect the good faith intention of giving adequate notice of the making of a claim, in the absence of giving adequate notice of the making of a claim, in the absence of relevant and applicable statutes and treaties. The purpose is to give the most practical available means of effectively publicizing an enterprise's claim, thereby putting all interested parties on notice (i.e., the notice was there and available to the world had any adverse claimant but taken reasonable steps to inform themselves of the facts).⁴⁷

Although, as described above, a private enterprise could proceed independently of congressional action, there is much more security in operating within the confines of a specific document than by actions drawn from inferences of past conduct.

Numerous studies were introduced into the record during the hearings highlighting the increasing U.S. dependence on foreign sources of the metals contained in manganese nodules. One study prepared by Nancy P. Petersen and John R. Justus of the Congressional Research Service, Library of Congress, for the House Subcommittee on Oceanography included the data in Table 20:

⁴⁵ *Ibid.*, p. 488.

⁴⁶ *Ibid.*, p. 489.

⁴⁷ *Ibid.*, p. 527-528.

TABLE 20.—CHANGING IMPORT REQUIREMENTS OF THE UNITED STATES

[Net imports as a percent of domestic use]¹

Commodity	1950	1960	1970	1971
Manganese.....	77	92	94	96
Cobalt.....	92	75	96	75
Nickel.....	99	88	91	66
Copper.....	35	9	8	6

¹ Net imports include semirefined forms.

Sources: (1) Final report of the National Commission on Materials Policy. Washington: June 1973. p. 2.23. (2) "The Stockpile Problem." American Mining Congress. Washington: June 1973. p. 4.

Again both subcommittees refrained from pressing action on the legislation in order to await the final report of the United Nations Seabed Committee and the initiation of the Law of the Sea Conference.

THE SECOND SESSION

Finally, on January 28, 1974, Senator Metcalf and 6 cosponsors introduced Senate Amendment No. 946 in the nature of a substitute for S. 1134. This legislation was first introduced as a new bill, S. 2878, on January 23, 1974, and referred to the Committee on Commerce. Consequently, in order to continue hearings in the Committee on Interior and Insular Affairs, Subcommittee on Minerals, Materials and Fuels, the sponsors introduced the same bill as Amendment No. 946 to S. 1134. The companion bill, H.R. 12233, was introduced into the House by Representative Thomas Downing and 12 cosponsors. Hearings were held by the House Subcommittee on Oceanography on February 26, 27, and 28, 1974.⁴⁸ The Senate Subcommittee on Minerals, Materials and Fuels held hearings the following week.⁴⁹

In the Senate hearings, Subcommittee Chairman Metcalf stated:

Our staff rewrote this legislation to meet the major objections of responsible spokesmen at previous hearings. As far as I know, the perfect piece of legislation has yet to be drafted. I am among those who have questions about the material before us. This, of course, is the reason for legislative hearings.⁵⁰

A number of basic changes were incorporated into Amendment No. 946 so that it differed significantly from S. 1134. Among the changes made were:

(1) Establishment of a moratorium on commercial development until January 1, 1976, to allow adequate time for international agreement through the Law of the Sea Conference according to the time frame regarded as adequate by Administration spokesmen.

(2) Elimination of the subsurface block concept so that the leased area includes only the seabed and subfloor to a depth of 10 meters below the water-sediment interface.

(3) Narrowing the definition of hard minerals to ferromanganese nodules or accretions.

⁴⁸ Deep Seabed Hard Minerals, *op. cit.*, pp. 355-513.⁴⁹ U.S. Congress, Senate, Committee on Interior and Insular Affairs. Mineral Resources of the Deep Seabed. Hearings before the Subcommittee on Minerals, Materials and Fuels on Amendment No. 946 to S. 1134. 93d Cong., 2d sess. Mar. 5, 6, and 11, 1974. Washington, D.C., U.S. Govt. Print. Off., 1974, Part II, pp. 769-1355.⁵⁰ *Ibid.*, p. 795.

(4) Elimination of the concept of reciprocating States which were defined as States having similar legislation or with which the United States establishes a comparable interim policy.

(5) Elimination of the escrow fund which was derived from part of the license fees and tax revenues from deep seabed mining operations to provide financial assistance to developing reciprocating States.

(6) Elimination of the concept of an international registry clearinghouse to record licenses and keep records and place this function with the Secretary of the Interior.

(7) Raising of the license fee from \$5,000 to \$50,000.

(8) Reduction of the license term to 10 years and, where commercial recovery begins within 10 years, the license is in force so long as commercial recovery continues but not to exceed 20 more years. This differed from the previous provisions of a 15-year license term and no expiration for the duration of commercial recovery.

(9) Limiting to 5 the number of licensed blocks held at one time during the first 5 years.

(10) Requiring application for separate exploration and commercial licenses.

(11) Providing for public access to information via public hearings on license applications.

The new legislation appeared to be much more independent in its nature in that it tended to eliminate many of the provisions that related to foreign countries. It was also a tighter bill in that it incorporated a number of additional restrictions, reduced the scope of the licenses, and allowed a time period for international agreement to be reached before permitting commercial recovery.

In registering impatience over the lack of progress by the Administration in international negotiations and pointing out the increasing need to support American interests in deep seabed minerals, Senator Metcalf commented:

That's the last we've heard from President Nixon on this subject, which he said—or was quoted as saying—on May 23, 1970 was "urgent." I'm paraphrasing the quotation. He was quoted as saying that "the issue arises now—and with urgency." I suggest there may be something less than urgent about that 4-year-old urgency in the mind of the President. His inability or unwillingness to act are in sharp contrast to the Government of at least one other major developed power—the United Kingdom.

In the opinion of some Members of Congress, and I am among them, we should support the efforts of American industry to go after these minerals vital to our economy. On the basis of information available to us now, our support certainly need not go so far as that of the United Kingdom—but American industry may be able to make such a case. In any event, they should have something more to go on than a hollow statement from the President that he, almost 4 years ago, did not believe it either necessary or desirable to try to halt exploration and exploitation of the seabeds beyond the depth of 200 meters while we seek international agreement on who shall develop seabed resources.

Of course, it would be preferable to carry forward such exploration and development under an international agreement. But I am realistically pessimistic about our ability to achieve such an agreement in an assembly dominated by the world haves-nots, whose primary interest in the seabed demonstrated to date is the intent to rip off what they can from the handful of developed nations with the wherewithal to develop these seabed minerals.

Time is running out for our economy unless we find new sources of the minerals we must have—and soon. I feel this Congress would make a horrible

mistake if we were not to do what we can to help our nationals develop the minerals we need—at least to exert some measure of control over them, pending international agreement.⁶¹

Although Administration spokesmen still could not support enactment of the bill for diplomatic reasons, they did find many of the new provisions acceptable. Accordingly, Mr. John Norton Moore, Chairman, National Security Council's Interagency Task Force on Law of the Sea, and Deputy Special Representative of the President to the Law of the Sea Conference, testified:

We agree with the underlying premise of the bill that by January 1, 1976, there must be an adequate legal regime for deep seabed mining under an internationally agreed regime in force on a provisional basis or, if this is not possible, then under appropriate legislation. In either event, we will support appropriate legislation regarding the conduct of U.S. nationals and the role of Federal agencies. We are mindful in this regard that U.S. firms are making substantial investments in deep seabed mining and are rapidly approaching the point where they must make even greater investment decisions.⁶²

In addition to adversely affecting the progress of the Law of the Sea negotiations, Mr. Moore enumerated four other points of disagreement dealing with the substance of the bill. First, he objected to the provision of licensing before 1976. He suggested that some nations might regard exclusive exploration rights as an attempt to preempt international negotiations rather than the intended objective of establishing some domestic priority among U.S. nationals.

The second point Mr. Moore raised dealt with the lack of flexibility in the bill to deal with the U.S. proposal for provisional application of an internationally agreed regime. He said that domestic legislation should be prepared to implement a provisional regime "very soon in 1975."

Third, the guarantee and insurance provisions of the bill would require the U.S. Government to assume liability to private investors for the Government's exercise of normal treaty-making powers. This would also place the Government in the role of a direct insurance underwriter when this function should belong to the private sector.

Finally, Mr. Moore conveyed the position of the executive branch that there are serious problems with the resource management provisions of the bill. Specifically, there are no provisions for royalties, or other revenues, flags of convenience, safety of life at sea, and marking and lighting of offshore mining facilities. He also suggested that there are problems with the environmental aspects of the bill that would need further study.

Representatives of industry took issue with the points raised by the executive branch. In a letter to Senator Metcalf, John E. Flipse, President of Deepsea Ventures, listed 32 examples of programs whereby the Federal Government provided relief insurance or guaranty pools for private investment. Furthermore, the industry viewpoint of the insurance provisions of the bill was that they only applied to loss through political interference, but did not provide complete coverage against loss of profit or against a wide range of damages.

In commenting on the new bill, Marne A. Dubs, speaking in behalf of the American Mining Congress and Kennecott Copper Corporation, did not object to elimination of the subsurface block concept and the escrow fund. He stated that industry looked with mixed views

⁶¹ *Ibid.*, p. 798-799, 836.

⁶² *Ibid.*, p. 930-931.

on the moratorium on commercial recovery before January 1, 1976. With regard to elimination of the reciprocating state concept, Mr. Dubs stated:

The elimination of the reciprocating state concept is a more serious matter, and we strongly urge the retention of this principle. It is this principle more than any other which operates "to promote the conservation and orderly development of hard mineral resources of the deep seabed." This principle tells all nations that the United States intends to cooperate with and take into account the operations of other nations. It states that the Congress of the United States, while passing what may appear to some to be narrowly nationalistic legislation, has in fact mandated a method of easily adjusting to the needs of other nations also anxious to utilize the resources of the deep seabed.⁵³

Mr. Dubs praised the redrafted bill for eliminating many of the generalities and nonspecificity of the regulatory provisions of the original bill. However, he suggested spelling out further the items for which the Secretary should promulgate rules and regulations. These would include:

1. Eligibility of applicants for license;
2. Licensing procedures (mechanics);
3. Procedures relating to work requirements;
4. Environmental procedures;
5. Multiple use questions; and
6. Definition and handling of and reporting of data.

He also suggested requiring the Secretary to issue regulations within 90 days and eliminating the time consuming requirement for public hearings on each license application. Mr. Dubs strongly recommended restrictions on the public disclosure of exploration data and mineral technology.

Spokesmen for environmental groups maintained their opposition to enacting any deepsea mining legislation at this time. Mr. Richard A. Frank speaking for the Environmental Defense Fund, the Sierra Club and other groups, repeated his basic position of the previous session. He maintained that the marine environment could be effectively protected only through international agreement. He did note that the new bill provided for more consideration of environmental questions. Mr. Samuel R. Levering of the U.S. Committee for the Oceans restated most of his previous objections and concluded that the bill was entirely unnecessary and would not accomplish its purpose of security of investment.

Again the record contained ample documentation of the U.S. dependence on foreign mineral supplies. Two U.S. Bureau of Mines charts inserted into the hearings of the Subcommittee on Minerals, Materials and Fuels pointed out that 1973 imports of raw and processed minerals exceeded exports by \$8 billion. Articles describing the Intergovernmental Council of Copper Exporting Countries (CIPEC) and drawing attention to the potential for controlling mineral markets by exporting countries were also inserted.

A study presented in a Department of State memorandum dated January 22, 1974, concluded that over the next 3 to 5 years the likelihood of a group of raw materials producers (other than oil) joining forces against the major consumers to influence their behavior for political purposes is negligible. The memorandum states that the producer countries could drive up prices but probably will not manage to

⁵³ *Ibid.*, p. 1018.

seriously restrict supplies other than copper and bauxite. The final conclusion presented in the memorandum states:

Although the risks that we shall have to deal with serious restrictions of supply in the next two or three years are small, they are not negligible and in the longer run U.S. dependence on foreign sources of raw materials is likely to increase. We should consider appropriate steps to reduce the possibility and effectiveness of aggressive action by producers to deprive us of adequate supplies.⁵⁴

Sensing that the Administration may be regarding the Deep Seabed Hard Minerals Act less than seriously, on June 3, 1974 Senator Lee Metcalf and Representative Thomas N. Downing sent a letter to the Secretary of Commerce, Frederick B. Dent (Appendix B) inquiring about the Administration's legislative approach on nodule mining announced 15 months earlier and what progress has been made on preparing an ocean mining environmental impact statement before the end of 1975 to serve as part of the governmental decision making process. The reply (Appendix C) indicated that NOAA was starting to implement plans for a 3-year Deep Ocean Mining Environmental Study.

Two months later, on August 21, as the first substantive session of the Law of the Sea Conference was sputtering to a close without producing anything of much substance, the Senate Interior Committee reported S. 1134, the Deep Seabed Hard Minerals Act, with Amendment No. 946 in the nature of a substitute as amended, Senate Report 93-1116 (reintroduced into the 94th Congress as S. 713, Appendix D). The amendments to Amendment No. 946 are interesting in that many of the original provisions of S. 1134 were restored or reinstated in a modified form as follows:

(1) Restores the reciprocating State concept but does not revive the escrow fund.

(2) Restores the license term to 15 years and if commercial recovery begins by then, for the duration of commercial recovery with no time limit.

(3) Provides protection for proprietary information, deletes the provision for public hearings, and speeds up the decision making period for granting licenses.

(4) Removes the limit on the number of blocks held simultaneously.

(5) Restores the international registry clearinghouse concept.

(6) Raises the schedule of minimum annual expenditures required to maintain a license prior to commercial recovery.

(7) Extends the time limit for relinquishment of 75 percent of the block from 10 years to 15 years.

(8) Further defines the limits of compensation for loss related to differing requirements of a future international regime.

(9) Provides for the formation of consortia by limiting United States guarantee insurance and compensation to the portion of the interest owned by U.S. interests.

These amendments to the bill, as reported out of committee, reflect many of the findings and substantive suggestions for improvement brought out in the preceding hearings. In general, the amendments make the conditions for deep seabed development more favorable for U.S. developers.

By unanimous consent, on September 4, 1974, the Senate took S. 1134 from the calendar and referred it to the Committee on Foreign Rela-

⁵⁴ *Ibid.*, p. 941.

tions from which it did not reappear during the 93d Congress. This course was taken by the Committee on Foreign Relations in support of the Administration position that no action should take place that might jeopardize the continuing Law of the Sea negotiations. The bills died with the close of the 93d Congress.

As time passed, U.S. seabed mining interests were losing patience with the legislative process and the U.N. deliberations. Instead, they began to seek security for future investments in the formation of international consortia for seabed mining. The first consortium involved Kennecott Copper Corporation, followed shortly by the CLB Group and Deepsea Ventures. After final action on S. 1134 appeared hopeless, on November 14, 1974, Deepsea Ventures, Inc. filed a "Notice of Discovery and Claim of Exclusive Mining Rights and Requests for Diplomatic Protection of Investment" (Appendix E). This notice was filed with the relevant Federal agencies, foreign embassies, and private corporations. The notice was accompanied by a legal brief documenting the justification for such action based on international precedent. While the Department of State did not officially recognize or grant exclusive mining rights to Deepsea Ventures, it did reply that mining of the seabed beyond the limits of national jurisdiction may proceed as a freedom of the high seas under existing international law (Appendix F).

LEGISLATIVE CONCERN IN THE 94TH CONGRESS

Deep seabed mining legislation was again introduced into the 94th Congress by Representative Thomas N. Downing (H.R. 1270) on January 14, 1975. The bill, which is essentially the same as the version reported out of the Senate Interior Committee in the 93d Congress, was referred to the House Committees on Merchant Marine and Fisheries and Interior and Insular Affairs. The identical bill, S. 713, was introduced into the Senate on February 18, 1975, by Senators Metcalf, Bartlett, Fannin, Hansen, Jackson, Johnston, and Moss. The bill was referred to the Committee on Interior and Insular Affairs with the stipulation that if and when reported the bill would be referred to the Committees on Armed Services, Commerce, and Foreign Relations for thirty days. The provision of a time limit of thirty days was intended to avoid the problem in the 93d Congress of the bill's becoming indefinitely tied up in another committee.

An indication that the Administration may also be starting to become somewhat less optimistic about the prospects for a successful outcome of the Law of the Sea Conference is evidenced by recent actions by the Department of Interior. On February 25, 1975 the Department announced the formation of an Ocean Mining Administration to promote and encourage ocean mineral resource recovery from the seabed and subsoil beyond the limits of national jurisdiction (Table 21). While officially stating that he has every hope that the Third United Nations Conference on the Law of the Sea will be concluded successfully, Secretary of the Interior Rogers C. B. Morton stated:

The Administration, however, mindful of its responsibilities to reduce wherever possible our nation's vulnerability to interruptible or high cost sources of raw materials, will have to be prepared to act through a domestic program to

secure our access to ocean minerals. We must create an investment climate which will promote the development of this new minerals frontier while at the same time protecting the ocean environment.⁶⁵

In a letter to Senator Metcalf dated February 24, 1975, Jack W. Carlson, Assistant Secretary of the Interior, further explained:

We continue to be hopeful that the Third UN Law of the Sea Conference will soon reach agreement on a satisfactory international system for managing minerals recovery from the seabed beyond national jurisdiction. In that event, the new Ocean Mining Administration will be in place to begin immediately the comprehensive task of harmonizing our programs with those established through the treaty. However, I believe that we must also be prepared if the Law of the Sea Conference does not reach a timely and successful conclusion, given our responsibilities to reduce wherever possible the Nation's dependence on foreign sources of raw materials.⁶⁶

Leigh S. Ratiner, who has been Director of the Ocean Mining Development Office on the staff of the Assistant Secretary—Energy and Minerals, was appointed Administrator of the Ocean Mining Administration. Mr. Ratiner has been actively concerned in possible deep seabed mining legislation for several years.

TABLE 21.—FUNCTIONS OF THE OCEAN MINING ADMINISTRATION

Functions		
Before 1976	Under a law of the sea treaty	Under a domestic program
Prepare and finalize environmental impact statement in close coordination with NOAA.	Insure compliance by ocean miners with treaty.	Comply with national environmental Policy Act: Review need for additional study before issuing mining authorization.
Supervise technology and resource assessment programs.	Process mining applications by U.S. nationals and coordinate with international authority.	Promulgate ocean mining regulations.
Draft ocean mining regulations for both domestic and international approach.	Promulgate regulations complimentary to those of authority.	Issue mining authorizations and insure compliance.
Continue active role in international negotiations on the law of the sea.	Promulgate regulations for submission of data.	Coordinate U.S. ocean mining regulations with those of other nations engaging in ocean mining.
	Promote development of knowledge about seabed.	Establish investment risk insurance program.
	Insure U.S. participation in international programs for technical assistance in ocean mining.	Continue environmental studies and technology and resource assessments.
	Assist international authority in environmental studies.	
	Nominate and supply U.S. experts to serve on international authority's commissions.	
	Review international authority's regulations.	
	Implement investment risk insurance program.	

Late in September 1975 the Department of Commerce established an Office of Marine Minerals (OOMM) within NOAA. The new office, headed by Amor L. Lane, will serve as the focal point for NOAA's new and expanding programs in marine minerals. The Deep Ocean Mining Environmental Study (DOMES) is the major project now under the new office.

Hearings were held on S. 713 on November 7, 1975 at which time industry representatives were asked to describe the current state of the art for nodule mining and discuss needs that could be met through Congressional action.⁶⁷ Mr. Marne A. Dubs, Director of the Ocean

⁶⁵ Metcalf, Lee, Ocean Floor Mining. Congressional Record, Feb. 26, 1975, p. S 2711.

⁶⁶ *Ibid.*, p. S2711.

⁶⁷ U.S. Congress. Senate. Committee on Interior and Insular Affairs. Current Developments in Deep Seabed Mining. Hearing before the Subcommittee on Minerals, Materials and Fuels. 94th Congress, 1st sess., Nov. 7, 1975, Washington, D.C., U.S. Govt. Print. Off., 1975, Part I, 249 p.

Resources Department of Kennecott Copper Corp., speaking on behalf of the American Mining Congress described the general position of seabed mining interests as follows: (1) some 200 potentially commercial mine sites have been identified but development without investment protection is financially very risky; (2) metallurgical problems of winning metals from nodules have largely been solved and tested at pilot plant level, but in order to design a commercial plant tests need to be run with nodules from a specific mine site; (3) mining systems have been tested at sea and there is no longer any doubt about the technical and economic feasibility of ocean mining. However, without protection from the risk that the industry will no longer be able to mine or would have investments impaired from financial burdens as a result of a LOS Treaty agreed to by the United States, and insurance against interference by foreign governments or firms against which there are no legal remedies available, mining interests are unwilling to commit the large expenditures necessary to enter into commercial mining operation.

Mr. John L. Flipse, President of Deepsea Ventures, Inc., stated that his firm has already slowed down its mining program to the point where it is now about two years behind the schedule it had originally set. Industry spokesmen suggested that if U.S. firms were to falter, deep ocean mining would likely proceed under the leadership of foreign members of the consortia, most of whom are subsidized by their governments.

When asked whether an insurance type of bill rather than a licensing scheme would provide sufficient investment incentive for deep seabed mining, Mr. Flipse informed the Committee that this fall-back position mainly assures the banks of getting their money back. However, the mining companies are interested in anticipating profits and could invest in other things such as risk-free securities if the only investment security for deep sea mining would be to cover any loss from foreign interference.

Mr. C. Thomas Houseman, Vice President and Technical Director, Mining, of the Chase Manhattan Bank, stated that with no legislation, he could not recommend to his bank that they invest in deep seabed mining. However, he agreed that an insurance bill would satisfy the bank's requirements for lending capital in an ocean mining venture.

Mr. Dubs suggested that an insurance scheme must somehow be tied into a sustained nodule supply and that a grandfather clause would have to be tied into any LOS Treaty he would want the United States to sign. He suggested that licensing might be used as a means of obtaining insurance under an insurance bill.

Something on the order of a 10-year financing package would be needed for ocean mining (four years for the investment in and construction of equipment, and six years cashflow from the project to retire the outstanding debt). Not only do banks and mining companies take a long term view, but there is a growing concern over dependency on foreign imports of mineral resources. As Senator Metcalf pointed out;

As you know, the members of this committee have a real interest in deep-sea mining, and are not so concerned with whether or not you people are going to get your money back.

We are concerned with the development of the resources, and encouraging you to go forward with providing the United States with resources that are in very scarce supply. And as we look ahead, it looks as if we are going to be in the same situation insofar as many of these valuable mineral resources as we are in oil and in other energy sources...

I don't think we would be very much interested here in the Congress in this legislation unless we were thinking and hoping that we were going to insure an additional supply of very valuable and important and scarce mineral resources in the years ahead to keep our economy going.⁵⁸

As a result of reorganization and new committee assignments in the House, Congressman John M. Murphy, Chairman of the Subcommittee on Oceanography, now has jurisdiction over deep seabed mining legislation in place of Congressman Downing. Congressman Murphy is expected to introduce and hold hearings on a new deep seabed mining bill early in the 2nd session of the 94th Congress. Action in the Senate is also expected early in the 2nd session.

⁵⁸ *Ibid.*, p. 19-20.

VIII. INTERNATIONAL CONSIDERATIONS

POSSIBLE CARTEL ACTION

The contribution to the U.S. trade deficit from imports of cobalt, copper, manganese and nickel raw materials totaled over \$1.1 billion in 1972 and is steadily increasing.¹ Faced with America's growing dependence on imports for most of the key raw materials consumed, the reliability of supplies from mineral exporting countries is being closely scrutinized. A number of recent articles have pointed out that several "third world" or developing countries have a sizable potential for exercising controlled market power.^{2 3} For example, four countries (Chile, Peru, Zambia and Zaire) control more than 80 percent of the copper exports on the world market, and have already organized the Inter-governmental Council of Copper Exporting Countries (CIPEC) to coordinate their oligopoly power. C. Fred Bergsten, senior fellow at the Brookings Institution, suggests that the cartel formed by the oil exporting countries is the prototype that will lead to the formation of other commodity cartels. He speculates further that unified action by exporters of different commodities, such as bauxite and copper, would reduce the threat of substitution.

However, a number of obstacles arise to the formation of commodity cartels. One obstacle is the economic option of using substitutes for some commodities as mentioned above. The solution of coordinating exports of several commodities, as Bergsten poses, only compounds a second and more difficult problem of achieving adequate cooperation among suppliers. Unlike the OPEC countries, the metal-exporting, non-industrialized countries do not have a surfeit of funds which can permit them to withhold or reduce supply for an indefinite period of time. In addition, the mineral exporting nations are of much more divergent economic, political, historical, and cultural backgrounds such that their chances of reaching a common agreement to withhold supply or produce an effective cartel are seriously limited. Another deterrent to establishing a producer cartel is the ability of consumer nations to stockpile some materials.

Some observers maintain that commonly shared social or political values are not essential to the formation of a cartel. Instead, mutual economic incentives are considered the primary motivation. It is also suggested that producer nations, frustrated in attempting to achieve other goals, may resort to extreme or even irrational policies in the management of their mineral resources. Should this happen, during a period of growing demand and overall scarcities, major consumer

¹ U.S. Bureau of Mines. Data in: Bullis, L. H. *Domestic Raw Materials Resources, Production, and Demand vis-a-vis Imports From Abroad*. Cong. Research Service Multilith, HF 1045, May 3, 1974, p. 28-31.

² Bergsten, C. F. The Threat From the Third World. *Foreign Policy*, No. 11, summer 1973. Reprinted in *Mineral Resources of the Deep Seabed Part II*, *op. cit.*, p. 815-818.

³ Fish, Sidney. Third World Goods Price Rise Feared. (New York) *Journal of Commerce and Commercial*, Dec. 27, 1973. Reprinted in *Mineral Resources of the Deep Seabed Part II*, *op. cit.*, p. 803-805.

nations could be faced with reduced materials imports and higher prices.

Others maintain that the OPEC example represents a unique case and cannot be duplicated by other industrial raw materials.⁴ The demand for petroleum is, at least in the short term, much less responsive to price increases because the industrialized world is heavily dependent on petroleum and alternative energy sources are not readily available. Also, it is claimed, the OPEC success was facilitated by the corporate behavior of the major oil companies, a situation not duplicated by other commodities.⁵

A State Department study titled *Raw Materials Other Than Oil as Economic Weapons Against the United States and Other Major Consumers* concluded that countries exporting critical raw materials such as copper and bauxite may be tempted to follow the example of the cartel of the oil producing countries by restricting production and raising prices, but they will probably be unsuccessful for lack of common economic and political objectives. For example, through lack of cooperation from Chile, the largest copper producer in CIPEC, the organization has not been effective. Chilean officials fear that the world economic situation would be further stressed by increased copper prices and limited output, which would damage Chile's economic interests in the long run. The State Department study pointed out:

The long-run interests of producers of all raw materials lie in not doing permanent harm to the economic well-being of the industrial countries. They threaten these interests only *in extremis* as perceived in terms of their own national interest. Only extreme and exceptional circumstances have enabled the Arab producing countries to stand more or less united on prices. On other issues they are still often at odds.⁶

Furthermore, the study suggests that even quite substantial price increases will result in relative small increases in prices of most finished products. In the long-run, with the single exception of diamonds, the few cartels which have held together were rarely able to garner significant windfalls for themselves. The avoidance of cutthroat competition among the members has been the major accomplishment of cartels in the past. However, others maintain that past failures took place largely during periods when buyers' markets existed for most commodities, whereas at present, sellers' markets appear to be the rule.⁷

Among the conditions listed in the State Department study for effective producer power were:

1. Producer control over a substantial share of world production entering into international trade;
2. Financial resources adequate to cover the loss of export earnings involved in restricting exports;
3. Inability of consumers to develop alternative sources of supply in short and medium-term;
4. Absence of consumer stockpiles;
5. Limited possibilities for substitution by synthetic or other natural materials; and

⁴ Krasner, S. D. One, Two, Many OPEC's . . . ? Oil is the Exception. *Foreign Policy*, No. 14, Spring 1974, p. 79.

⁵ *Ibid.*, p. 77-78.

⁶ Department of State Memorandum, Jan. 22, 1974. In *Mineral Resources of the Deep Seabed Part II op. cit.*, p. 943.

⁷ Bergsten, C. F. One, Two, Many OPEC's * * * ? (3) The Threat is Real. *Foreign Policy*, No. 14, Spring 1974, p. 85.

6. Political objectives and economic situations that are similar among producers, a condition which implies a relatively small number of producers.

Using these criteria the State Department analyzed the market situation for several industrial raw materials and found little likelihood of a serious threat to the United States. With regard to manganese ore, the principal sources for the United States are South Africa, Gabon, Brazil, and Zaire. India is another major producer. The likelihood of this group forming an effective cartel was considered small, but suppliers to the U.S. market were individually able to obtain substantially higher prices in recent negotiations despite releases from the GSA stockpile as a bargaining measure.

A copper cartel, CIPEC, has existed since 1967, but thus far has failed to function effectively as a bargaining group. Copper prices reached a record high in the second quarter of 1974 due to factors unrelated to cartel action, and prices have been declining since. The United States is a major copper producer and would be less affected by a successful copper cartel than other industrialized countries.

Cobalt is produced as a byproduct and cartel of cobalt exporting countries would have to depend to some extent on the mining and processing of iron, copper, and nickel. Among the developing countries producing cobalt, that could possibly form a cartel, are Zambia, Zaire, Morocco, and Cuba. It is not considered likely that the United States would be significantly affected by a cobalt cartel of these countries. Although we import essentially all the cobalt we consume, the total requirement is relatively small, and other producers are available.

Exports from Canada account for most of the nickel consumed in the United States. Developing countries, primarily Cuba and Indonesia, produce only 13 percent of the world mine production of nickel. A nickel cartel that did not include Canada would hardly be considered effective, especially against the United States. However, although Canadian and U.S. friendship has strong diplomatic, cultural, and strategic ties, Canada is becoming increasingly independent in foreign policy and economic diplomacy. Canada is reassessing its role as a raw mineral exporter and attempting to increase Canadian ownership of foreign investments.

A report prepared by the Congressional Research Service titled, *Domestic Raw Materials Resources, Production, and Demand vis-a-vis Imports From Abroad*, concluded:

In general, the situation regarding potential formation of materials cartels by Third World nations is unclear. Powerful arguments can be raised on both sides of the question * * * However, in view of the increasing dependence of the United States upon many of these cartel-candidate materials, it is clear that the possibility of cartels cannot be dismissed out of hand.⁸

Thus far, the discussion of cartels has concerned only present land-based mineral exporting countries. The position taken by the Group of 77, representing about 100 developing countries, in the Third U.N. Law of the Sea Conference, would establish a regime that would give the United Nations a "cartel" with essentially arbitrary powers in deep seabed mining and metal production. The United States and delegates of other industrialized countries are generally opposed to vesting this

⁸ Bullis, *op. cit.*, pp. 19-20.

degree of authority in a United Nations body controlled by nations whose interests are frequently opposed to our own.

UNITED NATIONS ACTIVITIES AND RELATIONS

United Nations involvement in the deep seabed has included direct funding for nodule surveys and sponsoring conferences on the Law of the Sea to establish an international legal framework for deep ocean exploitation.

NODULE SURVEYS

The United Nations Economic Commission for Asia and the Far East (ECAFE), through its Committee for Coordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas, is funding two nodule survey projects. These are in the vicinity of Tonga, Western Samoa, and Fiji who are interested in locating commercial nodule deposits near their shores.⁹

FIRST AND SECOND LAW OF THE SEA CONFERENCES

Four Conventions on the Law of the Sea were signed in Geneva in 1958 to codify international agreements regarding ocean space and national rights. A second conference was convened in 1960, but no additional agreements were reached. Consequently, these conferences and the resulting conventions left unresolved a number of questions and issues. One issue that was not resolved was the breadth of the territorial sea. Another related issue concerned the preferential rights of coastal states to the resources of the sea and deep seabed immediately beyond their territorial limit. The Convention on the Continental Shelf left open the area subject to a future international regime by incorporating an ambiguous definition of the continental shelf. The continental shelf was defined as "the seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 meters or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said areas."¹⁰ As technology pushed exploitability to greater and greater depths, the elasticity clause became more significant. However most authorities agree there is some point at which the seabed is beyond national jurisdiction. Debate mainly revolves around the concepts of whether the deep sea resources are nobody's property (*res nullius*), and therefore in principle subject to national appropriation, or everybody's property (*res communis*) and therefore not subject to any individual nation's appropriation or sovereignty.

On August 17, 1967, the Permanent Mission of Malta to the United Nations submitted a proposal urging that the resource wealth of the oceans be regarded as the "common heritage of mankind" to be used for the benefit, and in the interest, of mankind particularly developing nations. While the United States supported the U.N. resolution to this effect, statements by the U.S. State Department representatives have cautioned that "common heritage" does not mean "common property."¹¹

⁹ ECAFE, *op. cit.*, pp. 33-38.

¹⁰ 15 U.S.T. at 473, T.I.A.S. No. 5578, 499 U.N.T.S. at 312.

¹¹ U.S. Congress, Senate, Committee on Commerce, "Law of the Sea." Hearing before the Subcommittee on Oceans and Atmosphere, 992d Cong., 2d sess. Oct. 3, 1972. Washington, D.C.: U.S. Govt. Print. Off., 1972, p. 8.

An immediate outcome of the Malta proposal was a resolution, dated December 18, 1967, by which the U.N. General Assembly created an Ad Hoc Committee to Study the Peaceful Uses of the Seabed and the Ocean Floor Beyond the Limits of National Jurisdiction (the Seabed Committee). On December 21, 1968, one year and many background reports later, the General Assembly granted the Ad Hoc Committee permanent standing committee status. During its 1969 sessions the Seabed Committee determined to learn more about the content and location of the mineral wealth beneath the sea. Studies indicated that the major deep seabed resource beyond the continental shelves was ferromanganese nodules of which little was known of the costs of recovery and benefaction. Indications were that the nodule deposits could represent a vast untapped mineral wealth.

Many developing countries believed that the only effective way to share in this wealth would be to prevent the industrialized countries from proceeding to exploit the deep seabed. This strategy involved securing the adoption of four resolutions in the 1969 session of the U.N. General Assembly. The first of these resolutions, 2574 A (XXIV), requested the Secretary General to poll the member countries on the desirability of convening a Law of the Sea Conference in which the area of the seabed beyond national jurisdiction would be defined and a regime established to administer the development of this area. Resolution 2574 B (XXIV) requested the U.N. Seabed Committee to prepare a set of legal principles governing the seabed beyond national jurisdiction to be presented at the next session of the General Assembly. The Secretary General was also requested, Resolution 2574 C (XXIV), to review the various types of international machinery for a seabed regime. Passage of this resolution demonstrated that the developing countries were not interested in the previous report of the Secretary General that suggested a licensing or registration system rather than an operating agency. The final and most controversial resolution, 2574 D (XXIV), declared a moratorium on all exploitation of the seabed resources pending the establishment of an international deep seabed regime. Debate on this resolution highlighted the frustration of the developed nations in dealing with the growing majority of increasingly outspoken underdeveloped countries. The 1969 Moratorium Resolution was passed by a vote of 62 to 28 with 28 abstentions. The United States and other industrialized countries voted against the resolution. With passage of the Moratorium Resolution, the record was made clear that U.N. resolutions are only recommendations to governments and are not legally binding.

On December 17, 1970 the U.N. General Assembly adopted by a vote of 108 to 0 with 14 abstentions, the "Declaration of Legal Principles". Resolution 2749 (XXV), which stated:

The seabed and ocean floor, and the subsoil thereof, beyond the limits of national jurisdiction (hereinafter referred to as the area), as well as the resources of the area, are the common heritage of mankind.¹²

The United States voted for this resolution. Another principle in the Declaration restated the concept of an international regime for developing the seabed but did not attempt to define the type of regime.

¹² United Nations Doc A/6228, 1970.

U.N. RELATIONS AND THE THIRD LAW OF THE SEA CONFERENCE

The decision to convene a Third U.N. Conference on the Law of the Sea was formally made by the 25th U.N. General Assembly in December 1970 (U.N.G.A. Res. 2750 C (XXV)). A two-week organizational meeting of the Conference was subsequently scheduled to be held in New York in 1973 followed in 1974 by an eight-week substantive session in Santiago, Chile (later rescheduled for Caracas, Venezuela). The Seabed Committee was requested to prepare a comprehensive list of subjects and issues relating to the Law of the Sea and draft articles on these issues. In deliberations throughout the July and August 1971 session of the Seabed Committee, many proposals were set forth, but there was little agreement as to the form of control the international seabed regime should exercise. Debate centered on the type of regime, the machinery to regulate it, whether it should be independent or under the aegis of the United Nations, and the powers of the machinery. Suggestions for the machinery to regulate seabed mining include: (1) a registration system; (2) a licensing system; (3) an international monopoly wherein the regime can directly exploit resources; (4) a combination of direct operating authority by the regime, and licensing and/or registration by individual states.

The U.S. working paper detailed the structure for a strong international regime with the power to issue licenses on a nondiscriminatory basis to states and enterprises sponsored by states and procedures for compulsory settlement of disputes. Most of the developed nations also favored some form of licensing arrangement. On the other hand, the delegate from Trinidad and Tobago in summarizing the Latin American working paper stated, "The concept of a licensing or concession system is in our view inconsistent with the principle of common heritage"¹³ and advocated the direct exploitation concept to be developed initially through joint ventures or profit sharing arrangements. Spokesmen for the Soviet Bloc proposed a small agency with a small professional staff to provide administrative oversight of deep seabed mining.

During the years prior to the convening of the first session of the Third U.N. Law of the Sea Conference in 1973, the U.S. negotiating position underwent a major change in emphasis. From the time it was first formally announced in 1970, the U.S. position on the Law of the Sea met with opposition not only internationally but also at home. The initial position primarily reflected the strategic interests of the Department of Defense. This called for a renunciation of national claims to seabed resources beyond the depth of 200 meters and the establishment, beyond this point, of an international regime to govern the exploitation of seabed resources. This limit to seaward extension of the continental shelf boundary reflected military fears of expansion of coastal state sovereignty to ultimately close off U.S. military access to coastal areas and straits around the world and limit the placement of antisubmarine warfare (ASW) detection devices. The military influence even extended to advocating limited preferential rights for coastal nations over the fishery resources off their shores.

¹³ United Nations. Report of the Committee on the Peaceful Uses of the Seabed and the Ocean Floor Beyond the Limits of National Jurisdiction, General Assembly, Official Records, 26th session, supplement No. 21 A/8421, New York, 1971, p. 21.

As domestic industries became more active in the formulation of ocean policy, the priority accorded the military interests became more restricted. Whereas the military previously intervened in seabed as well as fisheries policy, it became largely restricted to policy inputs relating directly to military mobility—to straits and territorial sea boundaries affecting navigation. In response to strong industry pressure, an Advisory Committee on the Law of the Sea, consisting of 60 representatives of the industrial and scientific communities, was formed in early 1972. The official purpose of the Advisory Committee was to advise the head of the U.S. delegation to the U.N. Seabed Committee in the areas of petroleum, hard minerals, marine science, international law and relations, fisheries, international finance and taxation, marine environment, and maritime industries. The input from these domestic interests coupled with strong international pressures was apparent in the statements made by the chairman of the U.S. delegation to the Seabed Committee, Ambassador John R. Stevenson, on August 10, 1972 which placed a new emphasis on the national interest in ocean resources. Shifting from an earlier position stressing a species approach for international regulation of all fishing, the U.S. delegation indicated that it would accept coastal state management of coastal and anadromous species. Furthermore, the United States abandoned its position on a 200 meter isobath limit of national jurisdiction. The United States would accept coastal state regulation of mineral resources to the outer edge of the continental shelf or some specified distance from shore with other uses of the area unrestricted and pollution controls to be internationally determined. Another factor possibly influencing the shift in U.S. naval concerns is the development of new *Trident* submarine missiles with ranges up to 6,000 miles, reducing the need for submarines to enter straits-closed seas.

The first session of the Third U.N. Law of the Sea Conference convened in New York in November 1973 with discussion centering on procedural matters. Many of these were left unresolved and two additional weeks were added to the beginning of the Caracas session in 1974 for discussion of these matters. The initial lack of agreement on voting procedures and other preliminary matters marked an inauspicious beginning for the Conference, and to some observers suggested great difficulties would arise in reaching future substantive agreements.

In Caracas, the establishment of an international regime for deep seabed mineral exploitation was debated in Committee I. While the determination of the limits of national jurisdiction was placed in Committee II of the Conference, these limits bear directly on the work of Committee I. The major positions on this issue, as reflected in the first article of the draft proposals before Committee I, were (1) the limits of the Area (subject to international control of seabed resources) would be seaward of the limit of national jurisdiction established at the 500 meter isobath or 100 nautical miles from the coastal states baselines; (2) the limits of the Area would be the seaward limit of a Coastal Seabed Area of a breadth to be specified; and (3) the Area would commence at the lower edge of the continental margin or, if the edge were closer than 200 miles of the coast, then from a distance of 200 miles of the coast. In general, developing countries maintained claims to sovereignty or sovereign rights in a zone of 200 miles while allowing others only freedom of navigation, rights to lay cables and

pipelines, and the right to conduct scientific research subject to coastal State consent. Most developed countries would prefer a 12 mile territorial limit with the 200 mile area being an exclusive economic zone of the coastal state subject to international high seas freedoms. The coastal state would have the exclusive right only to explore for and to exploit living and non-living resources on and under the seabed and in the water column. A related unresolved issue is the question of the extent to which landlocked states and geographically disadvantaged states might be permitted to exploit the area within coastal state jurisdiction, or even traverse that area in order to reach international water.

Another area of disagreement is over the activities to be governed by the draft seabed treaty. One view suggests that *all* activities of whatever nature and scope (even, by implication, those unrelated to seabed mining) should be regulated. Another proposal is that only exploration and exploitation of the resources of the Area and other related activities should be covered. A third approach limits regulated activities to "industrial exploration and exploitation", thus leaving scientific research unconnected with these commercial activities free from regulation.

The exploitation system resolved into three major issues: (1) Who may exploit the area, (2) the conditions of exploitation, and (3) the economic aspects of exploitation. Several draft proposals were considered. Although differing in details, most draft proposals on the organizational structure of the international agency suggest: (1) an "Assembly" consisting of all parties to the treaty; (2) an executive "Council" with restricted membership but nevertheless representative of all major interests; (3) a Secretariat; and (4) an operational arm variously termed the "Enterprise," "Operations Commission," "Exploitation Commission," or "Permanent Board." The basic difference in approach is in the location of the voting power or decisionmaking authority within the organizational structure. The developing countries, because of their numerical superiority, support the concept of "one country one vote" and, thus, would place the decisionmaking power in the Assembly. The Council would carry out the day-to-day business of the organization within closely drawn policy lines determined by the Assembly.

The other basic position is to place the major executive power in the Council with authority for considerable flexibility in conducting the business of the organization. Various commissions could be established to advise the Council on technical and scientific matters. In this view, the Assembly would be primarily the political body to approve very broad policy issues. Most developed countries support this basic position.

Another difference in the draft proposals concerns the composition of the Council. The issue revolves around whether the Council should reflect accurately the political alignments and strengths of the Assembly or be weighted in some fashion to consider those interests who have the technology and financial resources required for seabed exploitation. A third approach, supported by the Soviet bloc, favors voting within the Council on the basis of equitable geographic representation (giving the developing countries two-thirds of the seats on the Coun-

cil) while requiring a unanimous vote or "common agreement" for decisions on substantive issues.

Three basic concepts have been suggested for the functions of the international agency. One proposal, basically the U.S. position, would empower the agency to issue licenses directly to the exploiting entity, whether state, private, or state-sponsored private. Under this system the agency would establish general rules for safe and orderly exploitation and exercise minimal control over the operations of the licensee. The international organization itself would not engage in exploration and exploitation.

Another proposal, representing the position of the Group of 77, would establish an Enterprise with a monopoly of seabed exploration and exploitation as an arm of the international organization. The Enterprise would completely control seabed exploitation, initially, through qualified state agencies or other entities and, eventually, entirely through its own funds, equipment, and personnel.

The third basic concept, somewhere between the other two, proposes an agency with the power not only to issue licenses, but also, at some future time, to develop the capability to explore and exploit seabed resources on its own in competition with state or private entities. This system is reflected in proposals to establish a Management and Development Commission, an International Seabed Operations Organization, and an Exploration and Production Agency of the organization.

The critical difference in these three concepts is in degree of control the international agency will exercise, through an appropriate organ, over seabed exploration and exploitation activities, and how much control will best obtain the maximum benefit for, and maximum protection of, the interests of mankind as a whole.

The United States took the position that the convention must guarantee access on a nondiscriminatory basis to deep seabed resources. Guaranteed access includes a requirement that mining rights be granted automatically to any qualified applicant. Furthermore, the United States advocated that the whole system for granting rights should be carefully structured in the treaty to insure that the system would be economically efficient and that exploitation would occur under a set of detailed conditions written into the treaty to guarantee the security of exploitation necessary to attract investments. Among the conditions stipulated was an application fee not to exceed \$50,000 for which the miner would receive the exclusive right to mine a tract not to exceed 30,000 square kilometers per area applied for. Other conditions required meeting a prescribed minimum time and expenditure schedule for progressing through evaluation to development.

In considering the economic effects of nodule mining on the economies of developing country metal producers, the United States opposed price and production controls on seabed operations. Uncertainties surrounding the estimates of economic damage to developing countries producing manganese, copper, nickel, and cobalt add to the politics of the issue. Some representatives of developing countries also stated that price and production controls which maintain artificially higher prices would not be desirable.

The Group of 77 (now 106 developing countries) formed a bargaining team to support a mutually acceptable draft treaty representing

their interests. Initially, their position, although not unanimous, would only allow nodule exploitation directly by an international authority. Early in the session at Caracas, after negotiating among themselves, the Group of 77 introduced a new alternative text allowing the Authority to enter into contractual arrangements with private entities. Under this proposal the Authority would still retain direct and effective control over all activities. While this proposal is still not acceptable to the United States, it does represent recognition that at least in the early years of its existence the Authority could not develop the financial and technical capability to mine the seabeds.

In regard to the conditions of exploitation, the Group of 77 would grant the Authority far greater discretion in managing seabed operations than the United States could accept. Their draft would allow the Authority to discriminate among various ocean miners and to impose arbitrary and unreasonable terms and conditions. Other draft proposals by Japan and the European Economic Community permit licensing only to states rather than directly to private entities.

Following his return from Caracas, Ambassador John R. Stevenson testified before a joint meeting of the Subcommittee on Minerals, Materials and Fuels of the Senate Interior and Insular Affairs Committee and the National Ocean Policy Study of the Commerce Committee on September 17, 1974, stating:

As in other areas of the law of the sea, the United States has sought in the deep seabed negotiation to protect its principal national interest in access to these mineral resources not by sweeping generalities written into treaty articles, but rather by setting out detailed provisions that explicitly prescribe how the system will work, what will be the rights and obligations of both the international machinery established to govern exploitation and the prospective ocean miners who will do business under the system and what kinds of safeguards will be provided for ensuring that these respective rights and obligations are protected and fulfilled. Nevertheless, it is clear that inclusion in the convention of a detailed mining code alone would not fully protect our interest in guaranteed access, and thus the United States position also depends on achieving an appropriate balance in decision-making organs that realistically reflect existing interests, as well as providing machinery for the compulsory settlement of disputes.¹⁴

In conclusion, Ambassador Stevenson summed up the seabed mining deliberations in Caracas by saying, "Committee I is perhaps our most difficult negotiation, rooted as it is in widely differing political and economic interests."¹⁵

While negotiations at the first substantive session of the Law of the Sea Conference in Caracas did not produce a treaty for deep seabed exploitation, they did affirm general agreement on broad principles and reduce the number of alternatives to choose from. Among the major policy objectives expressed were:

1. Encouraging the development of nodule resources. It was generally agreed that development of nodule resources is in the interest of mankind as it is questionable whether known land-based resources are sufficient to sustain long-term continued growth in material consumption.
2. Minimizing the impact of nodule mining on mineral exports of developing countries. Development of seabed resources will

¹⁴ U.S. Congress. Senate. Committee on Interior and Insular Affairs. Subcommittee on Minerals, Materials, and Fuels. Status Report on law of the Sea Conference. Hearings Part 2, Sept. 17, 1974, U.S. Govt. Print. Off., Washington, 1974, p. 853-854.

¹⁵ *Ibid.*, p. 863.

have an impact on the export earnings of a number of developing countries. Some forms of compensation, commodity agreements, or controlled nodule development were often advocated.

3. Ensuring the participation of developing countries in the nodule industry. The large capital requirements and sophisticated technical ability required for nodule mining would limit the industry to developed countries. Some form of participation is desired by developing countries, perhaps secured by restricting nodule mining to direct exploitation by an international authority. A more direct participation could be attained through joint ventures if a developing country had some capital to risk.

4. Securing revenues for the international authority. Since most of the benefits from nodule mining would accrue to the industrial nations who would mine nodules, revenues for the international authority well in excess of operating expenses could be extracted from nodule miners. On the other hand, the view was expressed that high revenues may be used to the benefit of less developed countries in the short term but may add to higher prices for manufactured goods, which would be detrimental to developing countries in the longer term.

5. Preservation of the marine environment. Prevention of pollution and contamination in the marine environment is a concern of most nations. Research, equipment design, and establishing proper operating procedures prior to nodule mining activities would be expected to minimize pollution potential. This could be enforced through an international regime.

6. Conservation of nodule resources. Although nodule deposits are continually forming and the current economically recoverable reserves are extensive, care must be taken to protect and conserve these resources.

Many of the above policy objectives are to some extent conflicting. It is whether or not agreement can be reached on the delicate balance and trade-offs of these objectives in consideration of the widely differing economic and political interests of many nations that will determine any future seabed treaty.

The second substantive session of the Third United Nations Law of the Sea Conference was held in Geneva from March 17 to May 9, 1975. The session concentrated on the translation of general outlines of agreement into an informal single negotiating (not negotiated) text covering virtually all the issues before the Conference. This text was finally prepared by the chairmen of the three main committees as proposed by the Conference President to "take account of the formal and informal discussions held so far."

In reporting on the progress in Geneva to the Senate Interior and Insular Affairs Committee joint meeting of the Subcommittee on Minerals, Materials and Fuels, on June 4, 1975, Ambassador Emeritus John R. Stevenson again found "it is now clear that the negotiation on the nature of the deep seabed regime and authority is the principal stumbling block to a comprehensive Law of the Sea Treaty." He explained:

The United States explored a number of approaches in an effort to be forthcoming with respect to developing country demands for participating in the exploitation system. We indicated our willingness to abandon the inclusion of detailed regulatory provisions in the treaty and to concentrate on basic conditions

of exploitation. We agreed to consider a system of joint ventures and profit sharing with the Authority. In addition, we proposed for consideration the reservation of areas (equal in extent and potential to those in which financial conditions were subject to the Basic Conditions) in which the Authority could negotiate for the most favorable financial terms it could obtain. The Soviet Union proposed a parallel system through the reservation of areas in which the Authority could exploit directly, while in other areas states could exploit under a separate system of regulation by the Authority. Both approaches were rejected by the Group of 77. Some developing country flexibility in the deep seabeds was demonstrated by their willingness to submit the entire exploitation system to the control of the Seabed Authority Council and to include representatives of designated developed and developing country interest groups on that body in addition to those selected on the basis of equitable geographic representation.¹⁶

In the same hearings Mr. John Norton Moore, Chairman, National Security Council's Interagency Task Force on the Law of the Sea and Deputy Special Representative of the President for the Conference on the Law of the Sea, stated that "it is now clear that the negotiations cannot be completed before mid 1976 at the earliest and at this time it is not clear whether or not a treaty can be completed during 1976." The Conference agreed to schedule the next session in New York for eight weeks beginning March 29, 1976. In the meantime, Ambassador Moore testified that the executive branch was "now conducting a thorough reevaluation of our interim policy. . . . We hope to complete our study and consultations by, or soon after, the August Congressional recess at which time we will submit to the Congress not only our recommendations concerning interim legislation, but also a full and frank evaluation of the factors that we have weighted."¹⁷

Acting in response to this informal commitment, on October 29, 1975, Senator Metcalf convened the fourth hearing before his Subcommittee on the status of negotiations at the U.N. Law of the Sea Conference. Speaking for the Administration, Carlyle E. Maw, interim chief of the U.S. delegation, reported that the review of the U.S. position would not be completed for a matter of months, but certainly before the March session in New York. For the first time, the Administration indicated some flexibility on the issue of whether passage of legislation would prejudice or preempt the Law of the Sea Conference. In response to questions from Senator Metcalf and Congressman Downing, Mr. Maw agreed that while it would depend on the specifics of the bill, legislation could possibly serve as a catalyst for negotiations.

Mr. Leigh S. Ratiner, Administrator of the Ocean Mining Administration of the Department of Interior, summarized the problem of finding some way to convince the developing countries of the firmness of our position and that it is time to make reasonable compromise. While not endorsing any legislation he stated:

We have said in the past that the bill which you introduced under circumstances prevailing, say a year ago, or two years ago, would be harmful to the negotiations. And I have, myself, said so at this table.

Senator METCALF. Let me interrupt. We have also, both in open hearings and in conferences, told you and told the other representatives that we would modify the legislation as we could to try to help you in your negotiations, isn't that correct?

Mr. RATINER. Yes, sir.

¹⁶ U.S. Congress, Senate, Committee on Interior and Insular Affairs, Subcommittee on Minerals, Materials and Fuels, Hearings, Status Report on Law of the Sea Conference, Hearing, Part 3, Washington, June 4, 1975, p. 1173-74.

¹⁷ *Ibid.*, p. 1175.

Mr. MAW. Mr. Chairman, may I interject here? This is the problem that we have very much in mind and which we are struggling with in our review. It depends of course—the effect of the legislation depends on the legislation. It depends upon the timing. It depends upon so many things.

That is why we want to consult with you, and as we develop our program for the oncoming session, we will come to you with the pros and cons. In strictest confidence, we have not resolved these issues as of this moment unfortunately, and I do not think we can resolve them within the next fortnight or two months.¹⁸

The value of passing legislation that would encourage U.S. deep seabed mining ventures and be an aid to the U.S. position at the LOS Conference was emphasized by Senator Metcalf:

If Congress passes a bill and the decision at the White House is to veto such a bill, I think we would have hindered our negotiations. And I do not think that we would want to do that. We want to work with the administration. We want to work with you people in finally getting our nationals out there mining the seabed, recovering this resource.

When are we going to know then what you are going to decide? It has been years. Now are we down to a matter of months? Is it March that you think you will know?

Mr. MAW. I think we have to have a policy decision in concurrence with you well before March.¹⁹

In late November, the White House announced the nomination of T. Vincent Learson, former President and Chairman of IBM Corp., to succeed Carlyle Maw, who had been an interim appointment to replace former Ambassador and Head of the U.S. Delegation John Stevenson. Ambassador Stevenson had resigned after the conclusion of 1975 session of the LOS Conference in Geneva, Switzerland.

POSSIBLE TREATY IMPLICATIONS

In view of the wide divergence of positions on seabed exploitation and heretofore general unwillingness to compromise among the participants in the Third United Nations Law of the Sea Conference several possible outcomes are likely, such as: (1) A timely, successful (acceptable to the United States), and effective treaty will be concluded; (2) no treaty will be concluded; (3) an ineffective treaty or general statement of principles agreeable to all will be adopted; (4) an open-ended conference with a general treaty agreeable to all, or to a majority, will be signed with substantive issues to be negotiated later; or (5) a treaty unacceptable to the United States will be adopted. An outcome along the lines of the first possibility would require major shifts in position, primarily by the developing countries. Although hope springs eternal, there is little indication to date that such a shift might occur. If a successful treaty were signed, it would preempt any domestic legislation, if existing, and probably require enabling legislation for ratification.

Since the Third U.N. Law of the Sea Conference was first proposed, pessimists have suggested that, in all probability, no treaty will be adopted. An ineffective treaty or broad statement with few specifics and generally agreeable to all, would be a face-saving conclusion for the participants, but would also be an unsuccessful result. Even

¹⁸ U.S. Congress, Senate, Committee on Interior and Insular Affairs, Subcommittee on Minerals, Materials and Fuels, Status Report on Law of the Sea Conference, Hearing, Part 4, Washington, October 29, 1975, p. 1451.

¹⁹ *Ibid.*, p. 1454.

Malta's ambassador to the United Nations, Dr. Arvid Pardo, the man reportedly most responsible for initiating the Law of the Sea Conference by declaring the sea's resources beyond the limits of national jurisdiction the "common heritage of mankind," expressed disappointment with the way things were turning out. "I suppose it would be better if there were no conference and no treaty at all."²⁰

An open-ended conference resulting in only a general treaty, leaving substantive issues to be decided later, would indefinitely postpone commercial seabed mining and, consequently, not be acceptable to mining interests who now have substantial investments in deep seabed mining technology. In such a case domestic legislation could provide a framework for regulating domestic mining interests during the interim period until a substantive international agreement can, if possible, be concluded. In the absence of domestic legislation, U.S. nationals could still proceed to commercial seabed mining at their own risks.

If a convention on deep seabed exploitation that is unacceptable to the United States were adopted, it might not be acceptable also to other technologically advanced countries whose corporations or governments have already invested large sums in deep seabed mining. Countries with such investments include the United States, Japan, Great Britain, France, West Germany, Australia, Canada, and the Soviet Union. Consequently, an international monopoly for seabed mining would have to develop or purchase its own expertise and technology for mining (by some means of financing at a level equal to approximately half the total budget of the United Nations) or else provide an attractive investment incentive or contract arrangement with countries or private entities that already have this capability.

The acceptance of a treaty agreement may also be influenced by conditions that may be treated as part of a package deal. Not only may trade-offs occur among different ocean uses, but trade-offs may be acceptable within a particular issue. For example, with regard to seabed mining, a restrictive treaty may be written favoring the conditions imposed primarily by one group while allowing existing seabed mining to continue (or, conversely, a treaty written differently and generally less restrictive, in conjunction with a temporary moratorium on deep ocean mining).

According to several observers, the chances are best that if a treaty is produced by the Law of the Sea Conference, it will come in 1976 or early 1977. If the Conference is not successful by then, it will probably drag on for several years or possibly the attempt will be abandoned.

Unless it became accepted law, an international convention is not binding except on the signatory countries. The strength of the convention lies in the extent of its acceptance among the countries most affected by it. For example, the 1973 Inter-governmental Maritime Consultative Organization (IMCO) Convention on Marine Pollution from Ships required ratification by 15 countries whose combined merchant fleets constituted not less than 50 percent of the gross tonnage of the world's merchant shipping before it enters into force. A convention on seabed mining would not be effective for controlling seabed exploitation unless it were ratified by most of the aforementioned coun-

²⁰ Alexander, *op. cit.*, p. 210.

tries with seabed mining interests. Judging from past experiences, if more than one or two of these countries did not sign the convention, it would carry less weight than desired despite the total number of signatories. The countries who do not become party to the convention would be free to mine the seabed subject to the public censure of the other nations. A case in point is Russia and Japan who did not sign the International Whaling Convention and continued to catch whales beyond their allotted quotas.

If the United States were not a signatory to a convention regulating the exploitation of the seabed, the only controls on U.S. mining interests would come from whatever legislation Congress might choose to enact. This legislation would not legally affect the right of U.S. nationals to mine the seabed but would regulate and control their operations. Such legislation has been introduced in the last three Congresses by Senator Lee Metcalf and others. These bills were initially supported by the mining interests as a means of investment security. While the bills would still supply that guarantee, if enacted, the mining interests no longer feel the need for them as strongly as before. This change has come about largely through the formation of international consortia for deep seabed mining.

U.S. companies are already on record stating they intend to mine the seabed despite the outcome of the Law of the Sea Conference. John E. Flipse, President of Deepsea Ventures, Inc., speaking at a National Advisory Committee on Ocean and Atmosphere (NACOA) meeting stated that Law of the Sea Conference results would not affect his firm's plans for reaching full scale production between 1978 and 1980.²¹

The Group of 77 has made it clear that it will hold the United States responsible for the actions of its nationals. Under present law, the United States has no legal means of stopping private corporations from seabed mining beyond national jurisdiction. If such legislation were enacted, U.S. mining interests could even attempt to register their ships in other countries or operate through foreign partners in consortia arrangements. In addition, the U.S. State Department has refused to recognize the mining claim filed by Deepsea Ventures, Inc. for an area beyond national jurisdiction in the Pacific Ocean, but did support their right to mine (at their own risk) in international water.

²¹ *Washington Report*, National Ocean Industries Association, Nov. 29, 1974, p. 4.

APPENDIXES

APPENDIX A

Letter from Charles N. Brower of the State Department to
Senator Henry M. Jackson

DEPARTMENT OF STATE,
Washington, D.C., March 1, 1973.

HON. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: In a letter to you on May 19, 1972, the Chairman of the Inter-Agency Law of the Sea Task Force indicated that the Executive Branch was not prepared at that time to state a position on S. 2801, the "Deep Seabed Hard Mineral Resources Act". A bill identical to S. 2801 has been reintroduced in this session of the Congress at H.R. 9. In his May 19th letter, the Chairman of the Task Force noted the connection of the bill with the Law of the Sea preparatory negotiations in the United Nations Seabed Committee, and said that we would report again on our views in the light of developments at the summer session of the Seabed Committee and the 27th United Nations General Assembly. This letter provides Executive Branch views on H.R. 9 supplemented by an appendix on the bill's mineral resource and technical aspects and their relationship to the negotiations.

By far the most important development at the 27th General Assembly regarding the Law of the Sea was the unanimous adoption of a Law of the Sea Conference Resolution. This resolution establishes a precise schedule for the Law of the Sea Conference and preparatory negotiations. Preparatory work in the UN Seabed Committee will be intensified in 1973, with provision for a five week session beginning in early March in New York and an eight week session beginning in early July in Geneva. The Resolution provides for convening a brief organizational session of the Law of the Sea Conference in New York in November/December 1973, and for convening a second session of the Conference, for the purpose of dealing with substantive matters, in Santiago, Chile in April/May 1974. There is also provision for such subsequent sessions of the Conference if necessary, as may be decided by the Conference with the approval of the General Assembly, at a subsequent session or subsequent sessions no later than 1975.

The Resolution also provides for the General Assembly to review at its 28th session next fall the progress of preparatory work and, if necessary, to take measures to facilitate completion of the substantive work for the Conference and any other action it may deem appropriate. As a strictly legal matter, such a clause is unnecessary since the General Assembly has his authority in any event. Its inclusion made it easier to accommodate concerns about proceeding to a Conference in the absence of adequate preparation. Moreover, we and others have made it clear that we will wish to seek an adjustment in the schedule in order to ensure that there are more than eight weeks of work in 1974.

The present hope of a large majority of States is that the kind of schedule outlined in the Conference Resolution can be met. This conclusion is necessarily based upon the expectation of important accomplishments in the preparatory work of the Seabed Committee in 1973.

As significant as the content of the Conference Resolution was the fact that it was adopted unanimously. All groups involved in its negotiation expressed great sensitivity to the concerns of other States, and great efforts were devoted to arriving at a resolution which could command not merely a majority or a 2/3 majority, but general support. This augurs well for the future of Law of the Sea negotiations, since a successful Law of the Sea Conference will necessarily require a similar attitude of mutual respect and accommodation.

Although not directly relevant to the legislation before us, there were other developments in the General Assembly this year that were less auspicious but which, nevertheless, merit reporting. A deep division of opinion developed regarding a request by certain land-locked and shelf-locked states for a study of the implications for the international seabed area of various proposed limits of national jurisdiction. It had been our hope that this issue could be resolved by negotiation and accommodation, but unfortunately, such an accommodation did

not in fact occur until after a number of close votes and intense debate. The ultimate result was the adoption of a revision of the land-locked/shelf-locked study resolution, as well as a companion resolution introduced by Peru calling for an analysis of the effect of different limits on coastal States. The U.S. has consistently supported reasonable requests for studies and information on Law of the Sea subjects, and in accordance with this policy we supported both the land-locked/shelf-locked proposal and the Peruvian proposal.

One other significant development at this General Assembly, fortunately in keeping with the spirit that dominated the negotiation of the Conference Resolution, was the fact that no new resolution calling for a moratorium on deep seabed activities was introduced. While it would not be accurate to interpret this as an indication that States supporting the earlier moratorium resolution have changed their opinion, we believe that the avoidance of a renewed and divisive debate on this subject was related to the general attempts to ensure the best possible atmosphere as we enter the final stage of preparatory work this year. Needless to say, our own opposition to the moratorium remains unchanged.

Turning to H.R. 9, the considerations expressed in our letter of May 19, 1972 on S. 2801 (identical to H.R. 13904) remain applicable, and generally set forth the factors affecting our approach to H.R. 9. In the time that has elapsed, however, we have been able to give further consideration to the matter in the light of international and domestic developments. We are accordingly in a position now to state a more definitive view on H.R. 9 and interim mining activities.

First, we adhere to the policy on this subject contained in the President's Oceans Policy Statement of May 23, 1970. We continue to believe that it is necessary to achieve timely widespread international agreement on outstanding Law of the Sea issues in order to save over two-thirds of the earth's surface from national conflict and rivalry, protect it from pollution, and put it to use for the benefit of all. It remains vital to all our national interests involved in the Law of the Sea Conference that the world agree on a treaty that will properly accommodate the many and varied uses of ocean space including the seabeds. At the same time we believe that it is neither necessary nor desirable to try to halt exploration and exploitation of the seabeds beyond a depth of 200 meters during the negotiation process, provided that such activities are subject to the international regime to be agreed upon, which should include due protection of the integrity of investments made in the interim period.

Second, we believe that there is reason to expect that the schedule for the Law of the Sea Conference outlined in the Conference Resolution just passed by the General Assembly will be adhered to. As previously indicated, the preamble of the Conference Resolution expressly states the expectation that the Conference will complete its work in 1974 or at the very latest in 1975.

Third, we believe that with the Law of the Sea negotiations moving into a critical stage, it is necessary for States to be very careful to avoid actions that can have an adverse effect on the negotiating atmosphere. It is apparent that S. 2801 (now H.R. 9), independent of the particular content or merits of the Bill, has become a symbol to many countries of defiance of the multilateral negotiating process. Regardless of our views on the intent and effect of the legislation, it may be argued by others that the legislation is similar to unilateral claims that we oppose and that are contrary to our security, navigation and resource interests, and moreover preempts the Law of the Sea Conference on this issue. It is well known that we have urged legislative restraint on other countries during the multilateral negotiating process even when they felt important interests were involved; we believe we should do the same so long as there are reasonable prospects for a timely and successful conference.

Fourth, we wish to insure that technology to mine the seabeds will be developed and that the United States will be able to look to seabed mineral resources as a new source of metals which would otherwise have to be imported with an attendant impact on our balance of payments and other interests.

Fifth, we also believe that a secure and stable investment climate must surround seabed mining activity under any new legal regime.

Sixth, we want to assure that all seabed mineral resource development will be compatible with sound environmental practices.

The adoption of the Conference Resolution indicates that we should distinguish between two different time periods. The first is the period between the present time and the conclusion of the Conference in 1974 or at the latest 1975.

The second is the period between the end of the Conference and the entry into force of a treaty.

With respect to the second time period, we believe it may be desirable for the Law of the Sea Conference to provide at its conclusion for immediate provisional entry into force of some aspects of the international seabed regime. There is an excellent precedent for this in the Chicago Civil Aviation Convention of 1944, which is one of the most widely ratified treaties in the world. This approach can accommodate the fears of many states that the establishment of an interim regime might still not lead to the establishment of a permanent regime, since in fact what we would be doing would be to bring certain parts of the permanent regime and machinery into operation earlier on a provisional basis. It is our intention to make clear in the international negotiations the advantages of, and the need for, the entry into force of a viable provisional international regulatory system for the deep seabeds as part of the general Law of the Sea treaty settlement in a way that ensures that the provisional system will be part of, and not a substitute for, the permanent system.

We will spare no efforts to ensure that a successful Law of the Sea Conference can be concluded on schedule. However, this does not mean that we intend to focus our efforts exclusively on the Law of the Sea negotiations.

Prudence dictates that we also begin at once to formulate a legislative approach on a contingency basis for two reasons. First, it could conceivably become clear during the negotiations that we have no reasonable basis for expecting a timely and successful Law of the Sea Conference. Second, we can prepare for provisional entry into force of some aspects of the international seabed regime once it is signed. While the approach in H.R. 9 does not appear to us to be satisfactory, we intend to continue the useful discussions we have been having with industry representatives and members of the public on this issue with a view to formulating such an approach within the Administration.

Similarly, we have had interesting discussions of this problem with other nations. In this connection, it must be borne in mind that economic as well as political factors make it necessary that we understand and take into account the interests and views of other countries on this subject. United States companies will not be alone on the deep seabeds, nor will the United States be the only country affected by their activities. Thus, we also intend to continue our consultations with other interested States on this subject, and in particular with those States whose nationals may in the foreseeable future be in competition with our own companies.

In this process, we will try to be guided by the need to avoid taking any definitive steps which would make the U.N. negotiations more difficult for ourselves or other nations, as well as the need to provide the essential elements of the financial security which industry considers necessary.

Let me be quite clear about the timing of this course of action. First, we will commence work on alternative approaches immediately, and will concentrate on the period between signature and entry into force of the treaty; second, we will want to make a continuing assessment of the negotiations to determine if a timely and successful Conference will occur; and third, we will not ask Congress to pass alternative legislation for the period before the conclusion of the Conference if a timely and successful Conference is predictable.

Let me also be clear as to what we mean by a "timely and successful" Conference. We would not regard a Conference as timely unless the schedule referred to in the preamble of the Conference Resolution is adhered to: in other words, a Convention, including arrangements regarding the provisional application of the international seabeds regime, would be opened for signature in 1974 or, at the latest, in 1975. In practical terms, this means not later than the summer of 1975, since many delegates would have to be present when the U.N. General Assembly convenes in September.

Similarly, we could no longer regard the likely outcome of a Conference as successful should it become apparent that other States are not prepared to accommodate basic United States interests in a final Law of the Sea settlement. In our statement of August 10, 1972, before the U.N. Seabed Committee, we reiterated what those interests are. Three paragraphs from that statement follow:

"The views of my delegation on non-resource uses have been clearly stated on a number of occasions. It is our candid assessment that there is no possibility for agreement on a breadth of the territorial sea other than 12 nautical miles. The United States and others have also made it clear that their vital interests require that agreement on a 12-mile territorial sea be coupled with agreement

on free transit of straits used for international navigation and these remain basic elements of our national policy which we will not sacrifice. We have, however, made clear that we are prepared to accommodate coastal State concerns regarding pollution and navigational safety in straits and have made proposals to that effect in Subcommittee II."

"The views of my delegation on resource issues have also been stated on a number of occasions. Unfortunately, some delegations appear to have the impression that maritime countries in general, and the United States in particular, can be expected to sacrifice in these negotiations basic elements of their national policy on resources. This is not true. The reality is that every nation represented here has basic interests in both resource and non-resource uses that require accommodation."

"Accordingly, we believe it is important to dispel any possible misconceptions that my government would agree to a monopoly by an international operating agency over deep seabed exploitation or to any type of economic zone that does not accommodate basic United States interests with respect to resources as well as navigation."

In another excerpt regarding the deep seabeds we stated: "An effective and equitable regime must protect not only the interests of the developing countries but also those of the developed countries by establishing reasonable and secure investment conditions for their nationals who will invest their capital and technology in the deep seabeds. In order to provide the necessary protections for all nations with important interests in the area, it is also necessary to establish a system of decision making which takes this into account and provides for compulsory settlement of disputes. We do not regard these objectives as inconsistent with the desire of other countries for equitable participation in deep seabed exploitation and its benefits."

For some time our experts have been engaged in a study of the economic implications of deep seabed mining legislation such as last session's S. 2801 and the current session's H.R. 9. They are examining issues of resource management and development, as well as questions of political economy such as the design of arrangements to ensure efficient exploitation of ocean resources. Implications for tax, customs and development finance policies are also under review.

The technology of ocean bed mining is likely to develop rapidly, and new information continually challenges old hypotheses. It is therefore impossible to be definitive. Nevertheless, at this time we are prepared to give you a comprehensive but as yet still incomplete report of the Administration's views on certain technical aspects of H.R. 9, particularly those related to resource management and development.

In reporting to you that the Administration is opposed to the enactment of H.R. 9, we want to make clear that this does not mean we are unalterably opposed to legislation of any sort, or that we intend to disregard the problem of interim mining. Any of a number of events could occur that would lead us to conclude that legislation was necessary, and we intend to prepare as quickly as possible for that contingency. Moreover, we wish to repeat that we continue to adhere to the President's statement that it is neither necessary nor desirable to try to halt exploration and exploitation of the seabeds beyond a depth of 200 meters during the negotiating process, provided that such activities are subject to the international regime to be agreed upon, which should include due protection of the integrity of investment made in the interim period. Our opposition to H.R. 9 in no way alters this.

We are deeply conscious of the fact that no decision we could have reached on this issue at this time could have been universally popular. Some who support the moratorium may not agree with the policy we have set forth. Some who support the approach in H.R. 9 may be equally disappointed. For the present, we think the middle course we have outlined is best. We hope the Committee will agree. However, we fully understand that the Committee, like the Administration, may wish to pay close and continuing attention to developments that could alter this assessment. We pledge our full cooperation with the Committee in those efforts.

The Office of Management and Budget advises that from the standpoint of the Administration's program there is no objection to the submission of this report.

Sincerely,

CHARLES N. BROWER,

Acting Legal Adviser and Acting Chairman, Inter-agency Task Force on the Law of the Sea.

APPENDIX B

Letter from Representative Thomas N. Downing and Senator Lee
Metcalf to Secretary of Commerce Frederick B. Dent

U.S. SENATE,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D.C., June 3, 1974.

Hon. FREDERICK B. DENT,
Secretary of Commerce, U.S. Department of Commerce,
Washington, D.C.

DEAR MR. SECRETARY: On several occasions, the Congress has had the benefit of testimony from Administration witnesses, including those representing your department, as to this nation's commitment to the development of deep ocean minerals.

Among others, Professor John Norton Moore of the Department of State, has advised us as to Administration policy on the issues which will be before the Law of the Sea Conference in Caracas, and of Administration efforts to provide for provisional application of certain aspects of the anticipated Convention. He has further assured us that, in the absence of a "timely" resolution by the Conference of the issues before it, the Administration is prepared to support domestic legislation to provide alternative solutions.

The Administration concept of a timely resolution of issues apparently is that described by Ambassador John R. Stevenson, Special Representative of the President for the Law of the Sea Conference, in his letter to the "Wall Street Journal", published January 7, 1974, and which Senator Metcalf read into the "Congressional Record" of January 21, copy attached.

We say "apparently," because in his March 1, 1973 letter to Chairman Jackson of the Senate Committee on Interior and Insular Affairs, as well as in his testimony before the House Subcommittee on Oceanography on the same date, Mr. Charles N. Brower, then Acting Legal Adviser to the Department of State and Acting Chairman, Interagency Task Force on the Law of the Sea, said that "prudence dictates that we also begin at once to formulate a legislative approach on a contingency basis . . .". Fifteen months later, we are still awaiting information on that legislative approach.

According to Professor Moore, one responsibility of the Administration in this area is the preparation of an environmental impact statement on the effects of deep ocean mining, such a statement to include the results of at-sea work to be carried out by "our" experts, and to be completed in time to serve as a part of the governmental decision-making process before the end of 1975. If that responsibility is to be carried out, we are now at the point, if indeed not past it, when we must make a vigorous, concentrated effort to acquire the necessary information and data upon which valid judgments may be based.

In view of the situation, we would appreciate your advising us at as early a date as is possible of the past efforts and present plans of the Executive Branch, and particularly of your own department, on the development of an ocean mining environmental statement, with emphasis on how the Executive Branch, is taking advantage of ongoing and future at-sea operations by American ocean miners.

We would like to know whether your attention to this problem area has been merely a token one or whether there has been any serious consideration and any development of actual plans to solve your problem, in other words, whether your efforts have really "made it to sea."

We would also appreciate being advised how the functional responsibilities of NOAA have been adapted to the program, how NOAA capabilities have contributed thereto, whether the recent discontinuation of the Marine Mining Technology Center at Tiburon indicates a lack of concern for the problem area, whether there have been any results to date, and whether the degree of effort is consistent with the "in any event by 1975 at the latest" deadline.

The only report we have thus far seen is the "Environmental Impact of Deep Sea Mining, Progress Report," by Dr. Oswald A. Roels of May 1973. That report, a summary of which was included in the 1973 "Mineral Resources of the Deep

Seabed" hearings by the Subcommittee on Minerals, Materials, and Fuels of the Senate Committee on Interior and Insular Affairs, consisted primarily of a literature review of the properties of the sea floor and water column in certain areas of the ocean. It did, however, also include what was called a technical plan, devised to furnish the information necessary for a final environmental impact statement. While that suggested plan might be criticized as being too long drawn out, it did at least represent a concrete suggestion for handling the problem. As to that plan, and your consideration thereof, we would appreciate answers to the following specific questions:

(1) Was there a consideration of the plan by NOAA, by your department, or by any other Executive agencies? If so, was the suggested plan approved, disapproved, or approved in part?

(2) Assuming that some plan has been adopted for implementation since May 1973, what are the constituent elements of the approved plan, what is the time frame for accomplishment of the various segments, and when will the final result be available?

(3) Again assuming some approved plan has been adopted, what agencies or departments are involved in its implementation, what levels of funding for the implementation have been recommended by whom, and what levels of funding have been approved by NOAA, by you, and by the Office of Management and Budget?

(4) If other departments and agencies are also involved in the implementation of the plan, please advise us of the same type of information on their funding levels or indicate to us where we might obtain that information.

We will appreciate your response to this letter at your earliest convenience. The letter and your response will be made a part of the record in future consideration of this problem.

Very truly yours,

THOMAS N. DOWNING,
*Chairman, Subcommittee on Oceanography, House Committee on Merchant
Marine and Fisheries.*

LEE METCALF,
*Chairman, Subcommittee on Minerals, Materials, and Fuels, Senate Com-
mittee on Interior and Insular Affairs.*

APPENDIX C

Letter from Secretary Frederick B. Dent to
Senator Lee Metcalf

THE SECRETARY OF COMMERCE,
Washington, D.C., July 12, 1974.

Hon. LEE METCALF,

Chairman, Subcommittee on Minerals, Materials, and Fuels, Committee on Interior and Insular Affairs, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: Thank you for your letter of June 3, 1974, concerning efforts being undertaken by the Administration, particularly the Department of Commerce and the National Oceanic and Atmospheric Administration (NOAA), related to the formulation of an environmental impact statement for deep ocean mining. I can assure you that the Department of Commerce and the National Oceanic and Atmospheric Administration are active in planning for obtaining the knowledge necessary to formulate a satisfactory environmental impact statement and recognize its importance to our ocean mining industry.

We have developed over the past several years a close working relationship with the ocean mining industry through the Mining Panel of the Ocean Science and Technology Advisory Committee (OSTAC) of the National Security Industrial Association (NSIA). This panel originally emphasized the importance of environmental studies for NOAA programs in support of the mining industry in recommendations to the Administrator of NOAA in June 1972. A NOAA program for environmental studies of sand and gravel operations on the Continental Shelf which had just been initiated to address the national need for construction aggregate was endorsed at that time. In addition the Panel urged that NOAA considered the environmental aspects of deep ocean mining. Subsequently, we have been involved in several related endeavors.

In consultation with the OSTAC Mining Panel, we have developed a program for deep ocean mining environmental related studies. Dr. Oswald A. Roels of the City University of New York has been carrying out scientific investigations in the Pacific under NOAA auspices. These investigations within the potential areas of deep ocean mining for manganese nodules are in addition to the report cited in your letter. In the draft environmental impact statement which has served to meet the requirements under the National Environmental Protection Act for the U.S. participation in the Law of the Sea Conference being held in Caracas, Venezuela, this summer, NOAA contributed the descriptions of natural conditions and the potential environmental impacts.

On the basis of our efforts through Dr. Roels and the development of the draft environmental impact statement for the Law of the Sea conference, NOAA has formulated in consultation with the ocean mining industry, a Deep Ocean Mining Environmental Study (DOMES) to assess the environmental factors associated with the deep ocean manganese nodule mining. A Project Development Plan prepared for this study in April 1974 outlines a three-year project to identify potential environmental problems sufficiently early to enable timely response to the requirements of the National Environmental Policy Act as well as to permit the development of environmental guidelines for industrial use in the design of mining equipment and operational techniques.

The project consists of two phases. Phase I is to be an effort to acquire data concerning the character of the environment in a typical mining area of the North Pacific Ocean prior to disturbance by mining devices. Phase II is to be an effort to test and refine predictive models developed in Phase I during a series of prototype mining equipment tests. While the Marine Mining Technology Center at Tiburon, California, has been closed, the environmental aspects of ocean mining at the Center have been integrated with the oceanography programs of the former Pacific Oceanographic Laboratories at Seattle, Washington, to form the Pacific Marine Environmental Laboratory. This combination of capability, located close to a major NOAA fisheries center in Seattle, provides the scientific basis needed to carry out the required environmental studies outlined in both phases of the Project Development Plan.

The Project Development Plan is now under review within the Department of Commerce, and resources have not yet been requested from the Office of Management and Budget. The Plan outlines a three-year program of \$2.9 million

\$2.6 million and \$2.3 million for each consecutive year. While other departments and agencies are not involved specifically in the implementation of the Plan, we intend to draw upon available data derived from other agencies in the development of our operational plans. We also have received endorsement for the Project Development Plan from the Council on Environmental Quality and the Environmental Protection Agency.

We appreciate your interest in this program and will advise you as to the outcome of our review of the Project Development for a deep ocean environmental study.

Sincerely,

FREDERICK B. DENT,
Secretary of Commerce.

APPENDIX D

Text of S. 713

IN THE SENATE OF THE UNITED STATES

FEBRUARY 18, 1975

Mr. METCALF (for himself, Mr. BARTLETT, Mr. FANNIN, Mr. HANSEN, Mr. JACKSON, Mr. JOHNSTON, and Mr. MOSS) introduced the following bill; which was read twice and, by unanimous consent, referred to the Committee on Interior and Insular Affairs if and when reported to be jointly referred to the Committees on Armed Services, Commerce, and Foreign Relations for thirty days

A BILL

To provide the Secretary of the Interior with authority to promote the conservation and orderly development of the hard mineral resources of the deep seabed, pending adoption of an international regime therefor.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*
3 That this Act may be cited as the "Deep Seabed Hard Min-
4 erals Act".

5 DECLARATION OF POLICY

6 SEC. 2. (a) Findings.—The Congress finds—

7 (1) that the Nation's hard mineral resource require-
8 ments will continue to expand in order to supply national

1 industrial needs and that the demand for certain hard
2 minerals will increasingly exceed available domestic
3 sources of supply;

4 (2) that, in the case of some minerals, the Nation
5 is totally dependent upon foreign sources of supply and
6 that the acquisition of mineral resources from foreign
7 sources is a substantial factor in the national balance-of-
8 payments position;

9 (3) that the national security interests of the United
10 States require the availability of mineral resources which
11 are independent of the export policies of foreign nations;

12 (4) that there is an alternate source of supply of
13 certain minerals which are significant in relation to
14 national needs contained in the manganese nodules which
15 exist in great abundance on the ocean floor;

16 (5) that, to the extent that such nodules are located
17 outside the territorial limits and beyond the Continental
18 Shelf of any nation, the nodules are available for utiliza-
19 tion by any nation with the ability to develop them;

20 (6) that United States mining companies have
21 developed the technology necessary for the development
22 and processing of deep seabed nodules and, given the
23 necessary security of tenure, are prepared to make the
24 necessary capital investment for such development and
25 processing; and

(7) that it is in the national interest of the United States to utilize existing technology and capabilities of United States mining companies by providing for interim legislation which will encourage further efforts to insure national access to available deep seabed hard minerals and to provide the means whereby the national program may be merged into an international program which evolves from negotiations on the Law of the Sea and is subsequently ratified by the United States.

(b) PURPOSES.—The Congress declares that the purposes of this Act are—

(1) to establish a national program to promote the orderly development of certain hard mineral resources of the deep seabed, pending the establishment of an international regime for that purpose; and

(2) to insure the establishment of all practicable requirements necessary to protect the quality of the marine environment to the extent that that environment may be affected by deep seabed hard mineral mining development.

DEFINITIONS

SEC. 3. For the purposes of this Act—

(a) “Secretary” means, except where its usage indicates otherwise, the Secretary of the Interior;

(b) “deep seabed” means the seabed, and the subsoil

4

1 thereof, lying seaward and outside the Continental Shelf
2 of any nation;

3 (c) "Continental Shelf" refers to the seabed and
• 4 subsoil of the submarine areas adjacent to the coast of
5 any nation (including the coasts of islands), but outside
6 the area of the territorial sea, to a depth of two hundred
7 meters or, beyond that limit, to where the depth of the
8 superjacent waters admits of the exploitation of the nat-
9 ural resources of the said areas;

10 (d) "block" means an area of the deep seabed hav-
11 ing four boundary lines which are lines of longitude and
12 latitude, the width of which may not be less than one-
13 sixth the length, comprising not more than forty thou-
14 sand square kilometers, and extending downward from
15 the seabed to a depth of ten meters;

16 (e) "hard mineral" or "hard mineral resources"
17 refers to nodules or accretions containing, but not limited
18 to, iron, manganese, nickel, cobalt, and copper;

19 (f) "development" means any operation of explora-
20 tion and commercial recovery, other than prospecting,
21 having the purpose of discovery, recovery, or delivery of
22 hard minerals from the deep seabed;

23 (g) "prospecting" means any operation conducted
24 for the purpose of making geophysical or geochemical
25 measurements, bottom sampling, or comparable activities

5

1 so long as such operation is carried on in a manner that
2 does not significantly alter the surface or subsurface of
3 the deep seabed;

4 (h) "person" includes private individuals, associa-
5 tions, corporations, or other entities, and any officer, em-
6 ployee, agent, department, agency, or instrumentality of
7 the Federal Government, of any State or local unit of
8 government, or of any foreign government;

9 (i) "eligible applicant" means a citizen of the
10 United States or a corporation or other juridical entity
11 organized under the laws of the United States, or its
12 States, territories, or possessions, and possessing such
13 technical and financial capabilities as may be prescribed
14 by the Secretary in order to assure effective and orderly
15 development of hard mineral resources pursuant to a
16 license issued under this Act;

17 (j) "investment" means a commitment of funds,
18 together with the interest costs thereof, commodities,
19 services, patents, processes, and techniques, dedicated to
20 the development of a licensed block or the processing of
21 the recovered minerals;

22 (k) "exploration" means the on-site observation and
23 evaluation activity following the location and selection
24 by an eligible applicant of a hard mineral deposit of po-
25 tential economic interest, which has, as its objective, the

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1 establishment and documentation of the nature, shape,
2 concentration, and tenor of an ore deposit, and the na-
3 ture of the environmental factors which will affect its
4 susceptibility of being developed, including the sampling
5 of the deposit necessary for the design, fabrication, instal-
6 lation, and testing of equipment;

7 (l) "commercial recovery" means recovery of hard
8 minerals at a substantial rate of production (without
9 regard to profit or loss), for the primary purpose of
10 marketing or commercial use and does not include re-
11 covery for sampling, experimenting in recovery methods,
12 or testing equipment or plant for recovery or treatment
13 of hard minerals;

14 (m) "reciprocating State" means any foreign State,
15 designated by the President as a State with requirements
16 and procedures comparable to those of the United States
17 under this Act, and which has undertaken to recognize
18 licenses issued under this Act; and

19 (n) "international registry clearinghouse" means a
20 recording agency or organization designated by the
21 President in cooperation with reciprocating States.

22 ACTIVITIES PROHIBITED

23 SEC. 4. (a) Except (1) as authorized pursuant to the
24 provisions of this Act, including subsection (b) hereof, (2)
25 as authorized under a license issued by a reciprocating State,

1 or (3) as may be authorized under a treaty, convention, or
2 other international agreement, which is binding upon the
3 United States, no person subject to the jurisdiction of the
4 United States shall engage directly or indirectly in the
5 development of hard mineral resources of the deep seabed.
6 The prohibition of this subsection does not apply to equip-
7 ment engineering development, prospecting, or scientific
8 research, nor to the rendering of contractual engineering,
9 construction, or other services, not amounting to actual
10 exploration or commercial recovery, nor to the furnishing
11 of machinery, products, supplies, or materials to any organi-
12 zation or person lawfully engaged in such development:
13 *Provided*, That the development does not infringe upon a
14 license recognized as exclusive under the provisions of
15 section 5 (b) hereof.

16 (b) In any case in which an eligible applicant is already
17 engaged in the exploration of a block, on the date on which
18 this Act takes effect, that eligible applicant may establish his
19 priority of right by filing an application for a license to de-
20 velop that block, without awaiting the issuance of applicable
21 regulations under section 18. Thereafter, he may continue
22 any exploration activities until such time as the Secretary
23 acts upon the application, with any activity subsequent to
24 the action of the Secretary to be determined by the decision
25 of the Secretary under the provisions of section 5 hereof.

LICENSE TO DEVELOP

SEC. 5. (a) GENERAL.—Pursuant to the provisions of this Act, the Secretary shall accept applications from, and issue licenses to, eligible applicants for the development of hard mineral resources of the deep seabed. Any license issued pursuant to this section shall be issued to the first eligible applicant who makes written application therefor, and tenders a fee of \$50,000 for the block specified in the application and available for licensing. Such fee shall be deposited into an appropriate fund to be established in the Department of the Treasury, which fund shall be utilized for administrative and other costs incurred in the processing of applications for licenses under this Act. The fund shall be available for such purposes only as appropriated to the Secretary annually therefor. Before he may issue a license, the Secretary must first determine, in the consideration of each license application—

(1) that the applicant is financially responsible and has demonstrated the ability to comply with applicable laws, regulations, and license conditions;

(2) that the operations under the license will not unreasonably interfere with other reasonable uses of the high seas, as defined by any treaty or convention to which the United States is signatory, or by customary international law;

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(3) that the issuance of a license does not conflict with any obligations of the United States, established by treaty or other international agreement; and

(4) that operations under the license will not pose an unreasonable threat to the integrity of the marine environment and that all reasonable precautions will be taken to minimize any adverse impact on that environment.

(b) NATURE AND DURATION OF LICENSE.—(1) Subject to the provisions of section 12 hereof, any license issued pursuant to this Act shall be exclusive as against all persons subject to the jurisdiction of the United States or of any reciprocating State, and shall authorize development of the hard mineral resources of the deep seabed for specified blocks thereof: *Provided*, That in no event shall any license issued under this Act authorize the commercial recovery of such resources prior to January 1, 1976: *And provided further*, That, except to the extent that such licenses are authorized pursuant to the provisions of an international agreement establishing a regime for the development of mineral resources of the international seabed area beyond the limits of coastal State territorial or resource jurisdiction, no licenses shall be issued under this Act subsequent to the ratification by the United States of any such international agreement.

1 (2) Priority of right for the issuance of a license shall
2 be created and maintained by receipt by the Secretary of a
3 license application from an eligible applicant: *Provided*, That
4 the application is submitted in conformity with the provisions
5 of this Act and the regulations promulgated by the Secretary
6 pursuant to section 18 hereof.

7 (3) An application, submitted in accordance with sub-
8 section (b) of section 4 hereof and prior to the effective date
9 of the regulations promulgated pursuant to section 18 of
10 this Act, shall be entitled to priority of right as established in
11 paragraph (2) of this subsection: *Provided*, That the eligible
12 applicant complies with the provisions of this Act, including,
13 but not limited to, the tender of the fee required by section 5,
14 the furnishing of information required by subsection (b) of
15 section 6, and the minimum expenditures required by sec-
16 tion 8: *Provided further*, That the eligible applicant brings
17 his application and his other activities into compliance with
18 all applicable regulations issued by the Secretary, as soon as
19 such regulations become effective.

20 (4) Every license issued under this Act shall remain in
21 force for fifteen years and, where commercial recovery of
22 the hard mineral resources has begun from a licensed block
23 within the fifteen-year period, such license shall remain in
24 force for as long as commercial recovery from the block
25 continues.

11

1 (e) TRANSFER OR SURRENDER OF LICENSE.—Any
2 license issued under this Act may be surrendered at will or,
3 upon written request of the licensee, may be transferred by
4 the Secretary to any other eligible applicant. Such license, as
5 issued or as transferred, may be revoked for willful, sub-
6 stantial failure to comply with the provisions of this Act,
7 with any regulation promulgated thereunder, or with any
8 license restriction or license condition: *Provided*, That the
9 Secretary has first given the licensee written notice of such
10 violation and the licensee has failed to remedy the violation
11 within a reasonable period of time. Upon such failure, the
12 Secretary shall notify the licensee in writing that he pro-
13 poses to revoke such license and that the licensee has thirty
14 days in which to request a hearing in accordance with section
15 554 of title 5, United States Code, on the issues raised by the
16 proposed revocation. The Secretary shall issue his decision
17 regarding revocation within thirty days after the notice of
18 proposed revocation, or after the completion of the hearings,
19 if such hearings are requested by the licensee in accordance
20 with this subsection. Any decision issued by the Secretary
21 after hearings shall be subject to judicial review in accordance
22 with the provisions of sections 701 through 706 of title 5,
23 United States Code.

24 (d) LICENSE CONDITIONS.—The Secretary is author-
25 ized to include in any license issued, or transferred, under

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1 this Act, any reasonable conditions which he finds neces-
2 sary to carry out the purposes of this Act. Such conditions
3 shall be prescribed on the basis of rules and regulations pro-
4 mulgated pursuant to section 18 of this Act.

5 LICENSING PROCEDURES

6 SEC. 6. (a) GENERAL.—The Secretary is authorized to
7 establish procedures governing the application for, and the
8 issuance of, licenses pursuant to this Act. Such procedures
9 shall contain an adequate mechanism for full consultation
10 with all other interested Federal agencies and departments,
11 and for the full consideration of the views of any interested
12 members of the general public.

13 (b) LICENSE APPLICATION.—Each application shall
14 contain such financial, technical, and other information as
15 is specified under rules and regulations promulgated pursuant
16 to section 18 of this Act.

17 (c) PUBLIC ACCESS TO INFORMATION.—(1) Copies
18 of any communications, documents, reports, or information
19 received from any applicant shall be made available to the
20 public upon identifiable request, and at reasonable cost, unless
21 such information may not be publicly released under the
22 provisions of this subsection.

23 (2) The Secretary shall not disclose information ob-
24 tained by him under this section which concerns or relates

1 to trade secrets or other confidential matter referred to in
2 section 1905 of title 18, United States Code.

3 (3) Nothing contained in this subsection shall be con-
4 strued to require the release to the public of any information
5 described by subsection (b) of section 552 of title 5, United
6 States Code, or which is otherwise protected by law from
7 such release.

8 (4) Prior to the issuance of the license, the following
9 specific information required to be furnished to the Secretary
10 under this Act and which is not otherwise protected from dis-
11 closure under paragraphs (2) and (3) of this subsection
12 may not be released outside the Government and may be
13 disclosed within the Government only on a strictly need-to-
14 know basis:

15 (i) coordinates of licensed blocks;

16 (ii) any other data which discloses directly or
17 indirectly the coordinates of licensed blocks; and

18 (iii) geological data related to the licensed block.

19 (d) NOTICE, DECISION AND REVIEW.—(1) Within
20 thirty days after receipt of an application, and prior to
21 granting a license, the Secretary shall publish in the Federal
22 Register a notice containing a summary of the application
23 and information as to where the application and the avail-
24 able supporting data may be examined allowing interested

1 persons at least sixty days for the submission of written data,
2 views, or arguments to the granting of the license. The
3 Secretary shall utilize such additional methods as he deems
4 reasonable to inform interested persons and groups about
5 the application and to invite their comments thereon.

6 (2) The Secretary's decision granting or denying a
7 license shall be in writing and shall be made within sixty
8 days following receipt of all views. The Secretary shall
9 grant the license applied for when he finds that the applica-
10 tion, as submitted, or as modified, meets the requirements
11 of this Act and the rules and regulations promulgated
12 hereunder.

13 (3) Judicial review of the Secretary's decision shall be
14 in accordance with sections 701 through 706 of title 5,
15 United States Code.

16 (4) The Secretary shall maintain a registry in which
17 is recorded the filing or withdrawal of an application for a
18 license under this Act, the issuance, denial, expiration, sur-
19 render, transfer, or revocation of such license, or the relin-
20 quishment of any licensed portion of the deep seabed. Subject
21 to the limitations of subsection (c) hereof, registry records
22 shall be available for public inspection during the business
23 hours of every working day.

24 (5) The Secretary shall, and the applicant or licensee
25 may, notify the international registry clearinghouse within

1 fourteen days of the filing or withdrawal of an application
2 for a license under this Act, the issuance, denial, transfer,
3 expiration, surrender, or revocation of such license, or the
4 relinquishment of any licensed portion of the deep seabed.

5 (6) The function of the international registry clearing-
6 house shall consist solely of keeping records of notices, or
7 applications for licenses, issuances, denials, transfers, or
8 terminations of licenses, and the relinquishment of licensed
9 portions of the deep seabed. Pending designation of such
10 clearinghouse, notice to the Secretary shall constitute notice
11 to the clearinghouse within the meaning of this Act.

12 ENVIRONMENTAL CRITERIA

13 SEC. 7. The Secretary shall consult with appropriate
14 Federal agencies and departments regarding environmental
15 criteria and shall establish objective environmental stand-
16 ards, based on technical and scientific data, applied in a
17 consistent manner under the rules and regulations of section
18 18, to which operations under a license issued under this Act
19 shall adhere. The Secretary may, from time to time, propose
20 revisions of the rules and regulations regarding environ-
21 mental standards, as scientific data may warrant.

22 MINIMUM ANNUAL EXPENDITURES

23 SEC. 8. (a) EXPENDITURES.—In connection with the
24 development of hard mineral resources from each licensed
25 block, the licensee shall make or cause to be made minimum

1 expenditures in the following amounts per block until com-
 2 mercial recovery from such block is first initiated:

Year:	Amount per year
1-----	\$100,000
2-5-----	200,000
6-10-----	500,000
11-15-----	1,000,000

3 The minimum annual expenditures required under this section
 4 shall consist of expenditures for operations, facilities, and
 5 equipment as required or utilized for the evaluation of the
 6 block for which the development license is issued. Such ex-
 7 penditures in any year in excess of the required minimum
 8 may be credited to requirements for later years.

9 (b) RECORDS.—Each recipient of a license under this
 10 Act shall keep such records as the Secretary shall prescribe,
 11 including records which fully disclose the expenditures for
 12 development required by this section, and such other records
 13 as will facilitate an effective audit of such expenditures.

14 (c) AUDITS.—The Secretary and the Comptroller Gen-
 15 eral of the United States, or any of their duly authorized
 16 representatives, shall have access for the purpose of audit and
 17 examination to any books, documents, papers, and records of
 18 the licensees that are pertinent to the expenditures required
 19 under this section.

20 AUTHORIZATION TO BEGIN COMMERCIAL RECOVERY

21 SEC. 9. Upon completion of its exploration activities at
 22 any licensed block, the licensee shall so notify the Secretary

1 and request from the Secretary an authorization to begin
2 commercial recovery. Upon receipt of such request, and sub-
3 ject to the provisions of section 12, the Secretary shall grant
4 such authorization: *Provided*, That the licensee is in compli-
5 ance with all conditions of the license and has furnished the
6 Secretary with copies of all raw data generated in the normal
7 course of the applicant's work on the block and relating di-
8 rectly to the documentation of the nature, shape, concentra-
9 tion, and tenor of the ore deposit of the licensed block and
10 the nature of the physical environmental factors which will
11 affect such commercial recovery.

12 AREAS WITHDRAWN FROM LICENSING; DENSITY

13 LIMITATIONS

14 SEC. 10. (a) No license shall be issued under this Act
15 for any portion of the deep seabed—

16 (1) which has been relinquished by the applicant
17 under a license issued under this Act within the prior
18 three years;

19 (2) which is subject either to a prior application for
20 a license, or an outstanding license, under this Act, or
21 from a reciprocating State; and

22 (3) which, if licensed, would result in a holding by
23 licensees under this Act of more than 30 per centum of
24 an area of the deep seabed which is within a circle with

1 a diameter of one thousand two hundred and fifty
2 kilometers.

3 (b) No license shall be issued or transferred under this
4 Act, and no person subject to the jurisdiction of the United
5 States shall have a substantial interest in a license issued
6 under this Act, which would result in any person directly or
7 indirectly holding, controlling, or having a substantial interest
8 in licenses for development of any portion of the deep sea-
9 bed which that person could not hold directly under this Act
10 in accordance with the limitations of this section.

11 RELINQUISHMENT OF LICENSED AREAS

12 SEC. 11. Within fifteen years of the license date for
13 any block, and not later than the grant of authorization to
14 exploit as provided for in section 9 hereof, the licensee shall,
15 by written notice to the Secretary, relinquish 75 per centum
16 of such block measured laterally. The relinquishment shall be
17 such that the unrelinquished area or areas shall conform
18 to the shape of a block as defined in section 3 hereof. The
19 licensee shall select the area of the block to be relinquished
20 and as many as four contiguous blocks of the same type held
21 by the licensee may be treated as a single unit for selecting
22 the area to be relinquished.

23 INTERNATIONAL REGIME

24 SEC. 12. At such time as an international agreement,
25 providing for the establishment of an international regime

1 for the development of the hard mineral resources of the
2 deep seabed, shall become binding upon the United States,
3 no additional licenses shall be issued pursuant to this Act, and
4 licenses previously issued under this Act shall be made sub-
5 ject to the provisions of that agreement. To the extent that
6 they are consistent with the provisions of the international
7 regime, licenses previously issued shall continue in effect, and,
8 to the extent possible under the international agreement, the
9 United States shall exercise its rights and responsibilities
10 under the agreement to insure their continuation under the
11 international regime.

12 INVESTMENT GUARANTY

13 SEC. 13. To the extent that an international agreement,
14 binding upon the United States, shall differ from the require-
15 ments of this Act, the United States shall provide the licensee
16 with compensation in an effectively realizable form represent-
17 ing the reduction in value of the investment resulting from
18 the differing requirements: *Provided*, That the liability for
19 compensation shall, until after an authorization for com-
20 mercial recovery has been granted, be limited to compensa-
21 tion in relation to equipment and facilities utilized for explo-
22 ration purposes: *Provided further*, That the Secretary of
23 Commerce shall determine in the first instance the amount
24 owing on the claims for compensation under this section:
25 *Provided further*, That after an authorization for commercial

1 recovery has been granted, the value of the investment shall
2 be determined by subtracting from the value of the original
3 investment any gross profits realized from development and
4 processing operations: *And provided further*, That the liabil-
5 ity under this section shall terminate ten years after commer-
6 cial recovery has begun.

7 INVESTMENT INSURANCE

8 SEC. 14. (a) On annual payment by any licensee of a
9 premium to be determined by the Secretary of Commerce,
10 utilizing standard insurance practices and based upon the
11 relative risks involved, the United States shall insure the
12 licensee, in an amount not exceeding the value of the invest-
13 ment, for any damages suffered through the impairment of
14 the insured investment, or through the removal of hard
15 minerals from the licensed block, by any other person against
16 whom a legal remedy either does not exist or is unavailable
17 in any legal forum to which the licensee has access. The
18 Secretary of Commerce shall determine the amount owing on
19 any claim for reimbursement under this section.

20 (b) Insurance under this section shall be available solely
21 upon the request of the licensee and after the Secretary of
22 Commerce has determined that the insurance coverage re-
23 quested is not readily available at a reasonable premium
24 elsewhere.

21

1 INVESTMENT GUARANTY AND INSURANCE FUND

2 SEC. 15. There shall be established in the Treasury of
3 the United States a Guaranty and Insurance Fund, which
4 shall have separate accounts to be known as the Guaranty
5 Reserve and the Insurance Reserve, which reserves shall be
6 available for discharge of liabilities, as provided in sections
7 13 and 14 of this Act, until such time as all such liabilities
8 have been discharged or have expired or until all such
9 reserves shall have been expended in accordance with the
10 provisions of this section. The Insurance Reserve shall be
11 funded by the premiums received from licensees, as provided
12 in section 14 of this Act, and the Guaranty Reserve shall be
13 funded by such sums as shall be appropriated pursuant to
14 section 22 of this Act.

15 NONDISCRIMINATORY TREATMENT

16 SEC. 16. For purposes of export controls, section 27 of
17 the Act of June 5, 1920, customs laws, and tax laws of
18 the United States, and the applicable implementing regu-
19 lations thereof, all hard minerals recovered from the deep
20 seabed under a license issued pursuant to this Act shall
21 be deemed to have been recovered within the United States,
22 and such laws, regulations, and controls shall be admin-
23 istered so that there will be no discrimination between

1 hard minerals recovered from the deep seabed and similar
2 hard minerals recovered within the United States.

3 CONSORTIA

4 SEC. 17. (a) In any case of agreement between United
5 States and foreign entities, with the resulting combination
6 of interests receiving a development license under the au-
7 thority of this Act, the applicability of sections 13, 14, and
8 16, of this Act shall be limited to the proportion of interest
9 owned by the United States entity or entities.

10 (b) In the case of an agreement between United States
11 and foreign entities with the resulting combination of in-
12 terests receiving a development license from a reciprocating
13 State, the provisions of section 16 of this Act, other than
14 the applicability of section 27 of the Act of June 5, 1920,
15 shall be applied as if the proportion of interest owned by
16 the United States entity or entities were licensed pursuant
17 to this Act.

18 REGULATORY AUTHORITY

19 SEC. 18. (a) The Secretary is authorized to issue such
20 reasonable rules and regulations as may be necessary to
21 carry out the provisions of this Act, other than the provisions
22 of sections 13, 14, and 15.

23 (b) The rules and regulations issued under subsection
24 (a) shall include provisions covering:

- 1 (1) eligibility standards and compliance;
- 2 (2) licensing procedures, requirements, and com-
- 3 pliance;
- 4 (3) work requirements compliance;
- 5 (4) environmental standards and compliance;
- 6 (5) multiple use standards and compliance; and
- 7 (6) other matters specifically delegated to the
- 8 Secretary under the Act.

9 (c) The Secretary of Commerce is authorized to issue
10 such reasonable rules and regulations as may be necessary to
11 implement the provisions of sections 13, 14, and 15 of this
12 Act.

13 (d) Rules and regulations issued under this section
14 shall be promulgated in accordance with provisions of sec-
15 tion 553 of title 5, United States Code.

16 JURISDICTION OF UNITED STATES DISTRICT COURTS

17 SEC. 19. United States district courts shall have orig-
18 inal jurisdiction of cases and controversies arising out of,
19 or in connection with, development activities conducted in
20 any area of the deep seabed under the authority of this Act,
21 and proceedings with respect to any such case or controversy
22 may be instituted in the judicial district in which any de-
23 fendant resides, or may be found, or in the judicial district
24 nearest the place where the cause of action arose.

24

PENALTIES

1
2 SEC. 20. (a) CIVIL PENALTIES.—Any person subject
3 to the jurisdiction of the United States who violates any
4 provision of this Act, or any rule or regulation issued pur-
5 suant to section 18 hereof, shall be liable to a civil pen-
6 alty of \$10,000 for each day during which the violation
7 continues. The penalty shall be assessed by the Secretary,
8 who in determining the amount of the penalty, shall consider
9 the gravity of the violation, any prior violation, and the
10 demonstrated good faith of the person charged in attempting
11 to achieve rapid compliance after notification of the viola-
12 tion. No penalty may be assessed until the person charged
13 shall have been given notice of the violation involved, and
14 an opportunity for a hearing. For good cause shown, the
15 Secretary may remit or mitigate any penalty assessed. Upon
16 failure of the person charged to pay an assessed penalty, the
17 Secretary may request the Attorney General to commence an
18 action in the appropriate district court of the United States
19 for collection of the penalty without regard to the amount
20 involved, together with such other relief as may be
21 appropriate.

22 (b) CRIMINAL PENALTIES.—In addition to any other
23 penalty, any person subject to the jurisdiction of the United
24 States who willfully and knowingly violates any provision of
25 this Act, or any rule or regulation issued pursuant to section

1 18 hereof, shall be punished by a fine of not more than
2 \$25,000 for each day during which such violation continues.

3 (c) LIABILITY OF VESSELS.—Any vessel, except a
4 public vessel engaged in noncommercial activities, used in a
5 violation of this Act, or of any rule or regulation issued pur-
6 suant to section 18 hereof, shall be liable in rem for any civil
7 penalty assessed or criminal fine imposed and may be pro-
8 ceeded against in any district court of the United States
9 having jurisdiction thereof; but, no vessel shall be liable un-
10 less it shall appear that one or more of the owners, or bare-
11 boat charterers was, at the time of the violation, a consenting
12 party, or privy to such violation.

13 ANNUAL REPORT

14 SEC. 21. The Secretary of Commerce and the Secretary
15 of the Interior shall each report to the Congress annually,
16 on or before June 30, with the first report to be made on or
17 before June 30, 1975, on his activities under this Act, in-
18 cluding recommendations for additional legislation as deemed
19 necessary.

20 AUTHORIZATION FOR APPROPRIATIONS

21 SEC. 22. (a) There are authorized to be appropriated
22 for the current fiscal year and for each of the two succeeding
23 fiscal years, such sums as may be necessary for the admin-
24 istration of this Act.

1 (b) There are authorized to be appropriated to the
2 Secretary of Commerce, to remain available until expended,
3 such sums as may be necessary from time to time to replenish
4 or increase the Guarantee Reserve of the Insurance and
5 Guaranty Fund, or to discharge the liabilities under section
6 13 of this Act.

7 EFFECTIVE DATE; SEPARABILITY

8 SEC. 23. This Act shall take effect on the date of its
9 enactment. If any provision of this Act or any application
10 thereof is held invalid, the validity of the remainder of the
11 Act, or of any other application, shall not be affected
12 thereby.

APPENDIX E

Deepsea Ventures, Inc.: Notice of Discovery and Claim of Exclusive
Mining Rights, and Request for Diplomatic Protection and Protec-
tion of Investment

DEEPSEA VENTURES, INC.: NOTICE OF DISCOVERY AND CLAIM OF EXCLUSIVE MINING RIGHTS, AND REQUEST FOR DIPLOMATIC PROTECTION AND PROTECTION OF INVESTMENT¹

[Filed, November 15, 1974]

NOVEMBER 14, 1974.

Hon. HENRY A. KISSINGER,
Secretary of State,
U.S. Department of State, Washington, D.C.

NOTICE OF DISCOVERY AND CLAIM OF EXCLUSIVE MINING RIGHTS, AND REQUEST FOR DIPLOMATIC PROTECTION AND PROTECTION OF INVESTMENT, BY DEEPSEA VENTURES, INC.

MY DEAR MR. SECRETARY: Deepsea Ventures, Inc., a Delaware corporation having its principal place of business in the County of Gloucester, The Commonwealth of Virginia, U.S.A., respectfully makes of record, by filing with your office this *Notice of Discovery and Claim of Exclusive Mining Rights and Request for Diplomatic Protection and Protection of Investment, by Deepsea Ventures, Inc.* (hereinafter "Claim"), as authorized by its Board of Directors by resolution dated 30 October 1974, a certified copy of which is annexed hereto as Exhibit A [not reproduced].

Notice of Discovery and Claim of Exclusive Mining Rights

Deepsea Ventures, Inc., (hereinafter "Deepsea"), hereby gives public notice that it has discovered and taken possession of, and is now engaged in developing and evaluating, as the first stages of mining, a deposit of seabed manganese nodules (hereinafter "Deposit"). The Deposit, illustrated by the sketch annexed as Exhibit B, is encompassed by, and extends to, lines drawn between the coordinates numbered in series below, as follows: [I.L.M. page 57]

From: (1) Latitude 15°44' N., Longitude 124°20' W. A line drawn West to: (2) Latitude 15°44' N., Longitude 127°46' W. And thence South to: (3) Latitude 14°16' N., Longitude 127°46' W. And thence East to: (4) Latitude 14°16' N., Longitude 124°20' W. and thence North to the point of origin.

These lines include approximately 60,000 square kilometers for purposes of development and evaluation of the Deposit encompassed therein, which area will be reduced by Deepsea to 30,000 square kilometers upon expiration of a term of 15 years (absent force majeure) from the date of this notice or upon commencement (absent force majeure) of commercial production from the Deposit, whichever event occurs first. The Deposit lies on the abyssal ocean floor in water depths ranging between 2,300 to 5,000 meters and is more than 1000 kilometers from the nearest island, and more than 1300 kilometers seaward of the outer edge of the nearest continental margin. It is beyond the limits of seabed jurisdiction presently claimed by any State. The overlying waters are, of course, high seas.

The general area of the Deposit was identified in August of 1964 by the predecessor in interest of Deepsea, and the Deposit was discovered by Deepsea on August 31, 1969.

¹ Reproduction from the text provided to *International Legal Materials* by Deepsea Ventures, Inc. The Notice was filed in the office of the U.S. Secretary of State on Nov. 15, 1974. An original was also filed and recorded as: (1) Deed Poll No. 1659 in the Office of the Clerk of the Circuit Court of Gloucester County, Virginia on Nov. 15, 1974; and (2) Deed Poll No. 02421 in the Office of the Recorder of New Castle County, Delaware on Nov. 22, 1974. Copies were also sent to the addressees listed in Exhibit E at I.L.M. page 63.

As of Jan. 15, 1975, there had been two responses to the notice: (1) a U.S. Department of State statement made available in response to press inquiries, and (2) a response from the Embassy of Canada at Washington, D.C. These appear respectively at I.L.M. pages 60 and 67. As other responses become available, I.L.M. will attempt to carry the text.

The Opinion of the Law Offices of Northcutt Ely on "International Law Applicable to Deepsea Mining," submitted to Deepsea Ventures, Inc., on Nov. 14, 1974, is available at the Library of the American Society of International Law.

Further exploration, evaluation, engineering development and processing research have been carried out to enable the recovery of the specific manganese nodules of the Deposit and the production of products and byproducts therefrom.

The work done, and in progress, is summarized in the annexed affidavits, Exhibits C and D. [I.L.M. pages 58 and 61.]

Deepsea, or its successor in interest, will commence commercial production from the Deposit within 15 years (absent force majeure) from the date of this Claim, and will conclude production therefrom within a period (absent force majeure) of 40 years from the date of commencement of commercial production whereupon the right shall cease.

Deepsea has been advised by Counsel, whose names appear at the end hereof, that it has validly established the exclusive rights asserted in this Claim under existing international law as evidenced by the practice of States, the 1958 Convention on the High Seas, and general rules of law recognized by civilized nations.

Deepsea asserts the exclusive rights to develop, evaluate and mine the Deposit and to take, use, and sell all of the manganese nodules in, and the minerals and metals derived, therefrom. It is proceeding with appropriate diligence to do so, and requests and requires States, persons, and all other commercial or political entities to respect the exclusive rights asserted herein. Deepsea does not assert, or ask the United States of America to assert, a territorial claim to the seabed or subsoil underlying the Deposit. Use of the overlying water column, as a freedom of the high seas, will be made to the extent necessary to recover and transport the manganese nodules of the Deposit.

Disturbance of the seabed and subsoil underlying the Deposit will be temporary and will be restricted to that unavoidably occasioned by recovery of the manganese nodules of the Deposit. To facilitate the United States of America's domestic policies and programs of environmental protection, Deepsea will provide, at no cost, reasonable space for U.S. Government representatives of the United States of America on vessels utilized by Deepsea in the development and evaluation of the Deposit. Deepsea does not intend to process at sea the manganese nodules from the Deposit.

It is Deepsea's intention, by filing this Claim in your office and in appropriate State recording offices, to publish this Claim and provide notice and proof of the priority of the right of Deepsea to the Deposit, and its title thereto.

A true copy of this Claim is being filed for recordation in the office of the Secretary of State of the State of Delaware, U.S.A., the State wherein Deepsea is incorporated, and on 15 November 1974 in the office of the Clerk of the Circuit Court of Gloucester County, Virginia, U.S.A., the county and Commonwealth of Deepsea's principal place of business. Copies of this claim are also being provided to others, as specified in the annexed Exhibit E. [I.L.M. page 63.]

We ask that this Claim, and all of the annexed Exhibits, be made available by your office for public examination.

Request for Diplomatic Protection and Protection of Integrity of Investment

Deepsea respectfully requests the diplomatic protection of the United States Government with respect to the exclusive mining rights described and asserted in the foregoing Claim, and any other rights which may hereafter accrue to Deepsea as a result of its activities at the site of the Deposit, and similar protection of the integrity of its investments heretofore made and now being undertaken, and to be undertaken in the future.

This request is made prior to any known interference with the rights now being asserted, and prior to any known impairment of Deepsea's investment. It is intended to give the Department immediate notice of Deepsea's Claim for the purpose of facilitating the protection of Deepsea's rights and investments should this be required as a consequence of any future actions of the United States Government or other States, persons, or organizations.

The protection requested accords with the assurances given on behalf of the Executive Department to the Congress of the United States, including those by Ambassador John R. Stevenson, by Honorable Charles N. Brower, and by Honorable John Norton Moore, as follows:

"The Department does not anticipate any efforts to discourage U.S. nationals from continuing with their current exploration plans. In the event that U.S. nationals should desire to engage in commercial exploitation prior to the establishment of an internationally agreed regime, we would seek to assure that their activities are conducted in accordance with relevant principles of international law, including the freedom of the seas and that the integrity of their

investment receives due protection in any subsequent international agreement." Letter of January 16, 1970, from John R. Stevenson, Legal Advisor, Department of State, to Lee Metcalf, Chairman, Special Subcommittee on the Outer Continental Shelf, U.S. Senate, reproduced in Hearings before the Special Senate Subcommittee on the Outer Continental Shelf, 91st Cong., 1st and 2d Sess. at 210 (1970).

"At the present time, under international law and the High Seas Convention, it is open to anyone who has the capacity to engage in mining of the deep seabed subject to the proper exercise of high seas rights of other countries involved." Statement of Charles N. Brower, Hearings before the House Subcommittee on Oceanography of the Committee on Merchant Marine and Fisheries, 93d Cong., 1st Sess., at 50 (1974).

"It is certainly the position of the United States that the mining of the deep seabed is a high seas freedom and I think that would be a freedom today under international law. And our position has been that companies are free to engage in this kind of mining beyond the 200-meter mark subject to the international regime to be agreed upon, and of course, assured protection of the integrity of investment in that period." Statement of John Norton Moore, Hearings before the Senate Subcommittee on Minerals, Materials and Fuels, 93d Cong., 1st Sess., at 247 (1973).

The language of these extracts, and other statements similar to them made by these and other responsible officers of the Executive Branch is consistent with the Executive's continuing practice as reflected in a paragraph in President Taft's Message to the Congress of December 7, 1909, where he said:

"The Department of State, in view of proofs filed with it in 1906, showing American possession, occupation and working of certain coal-bearing lands in Spitzbergen [Spitzbergen was at that time recognized as being not subject to the territorial sovereignty of any State] accepted the invitation under the reservation above stated [i.e., the questions of altering the status of the islands as countries belonging to no particular State and as equally open to the citizens and subjects of all States, should not be raised] and under the further reservation that all interests in those islands already vested should be protected and that there should be equality of opportunity for the future." *Annual Message of the President to Congress, 7 December 1909*, [1901] For. Rel. of the U.S. IX at XIII (1914).

Deepsea has used its best efforts to ascertain that there are no pipelines, cables, military installations, or other activities constituting an exercise of freedom of the high seas in the area encompassing the Deposit or in the superjacent waters, with which Deepsea's operations might conflict. So far as is known, no claim of rights has been made by any State or person with respect to said Deposit or any other mineral resources in the area encompassing the Deposit and no State or person has established effective occupation of said area.

Initially, approximately 1.35 million wet metric tons of nodules will be recovered by Deepsea from the Deposit per year. In accord with market conditions, this may later be expanded to as much as 4 million wet metric tons per year recovered. Deepsea's processing and refining technology, successfully demonstrated in its pilot plant, will recover copper, nickel, cobalt, manganese, and other products, depending on the market situation and competitive conditions. The recovered weight of the major four metals that the initial 1.35 million wet metric tons of nodules will yield per year will be approximately as shown in Column A below. Column B gives some indication of the dependency of the United States of America upon imports for these four metals.

	A	B
	Production (metric tons)	Net U.S. imports (1972) as a percentage of U.S. Consumption
Nodules.....	1,350,000	
Copper.....	9,150	9
Nickel.....	11,300	71
Cobalt.....	2,150	92
Manganese.....	253,000	93

The importance of these minerals to the economy of the United States does not require elaboration. It has been effectively expressed to the Congress by the Executive Branch.

For your information, the capital stock of Deepsea is at present wholly owned by nationals of the United States. Ninety per cent thereof is owned by Tenneco Corporation, a Delaware corporation, and the other ten percent is owned by individuals, all of whom are United States citizens. At this date stock options are outstanding which, if all are exercised, will result in acquisition of the following percentages of ownership of Deepsea's capital stock by others:

23.75 percent: Essex Iron Company, a New Jersey corporation, a wholly owned subsidiary of United States Steel Corporation, a Delaware corporation.

23.75 percent: Union Mines Inc., a Maryland corporation, a wholly owned subsidiary of Union Miniere, S.A., a Belgian corporation.

23.75 percent: Japan Manganese Nodule Development Co., Ltd., a Japanese corporation.

Respectfully,

DEEPSEA VENTURES, INC.²

² The Notice was signed by John E. Flipse, President, and Northcutt Ely, L. F. E. Goldie, and R. J. Greenwald, as Counsel. The signature of the President was duly notarized.

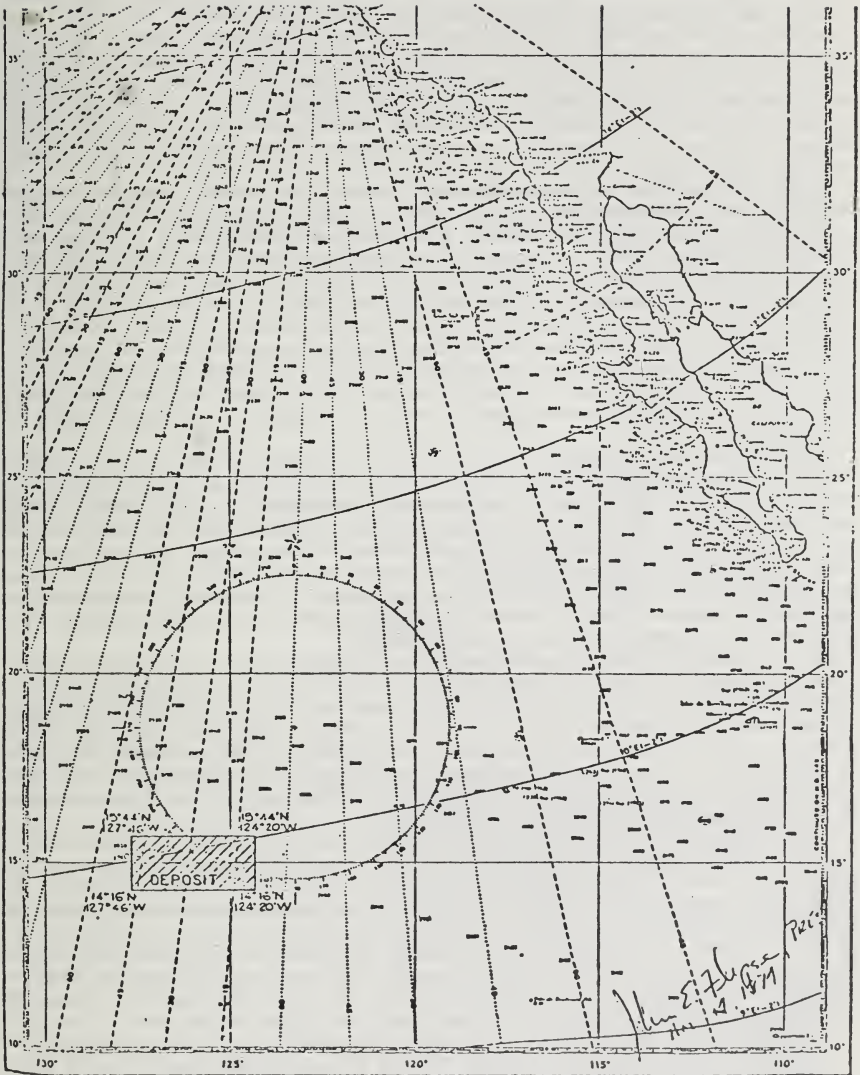


EXHIBIT B

North Pacific Ocean - Eastern Part
 REPRODUCED BY PERMIT - SCALE 1:100,000

N.O. 520
 (Formerly N.O. 522)

EXHIBIT C

SWORN STATEMENT

DISTRICT OF COLUMBIA, ss:

John E. Flipse, being duly sworn, deposes that:

1. He resides at the Cove, Gloucester, Virginia, U.S.A., and that he is a citizen of the United States of America, and that he is 53 years of age.
2. He was, from September 1957 to October 1968, employed by the Newport News Shipbuilding and Dry Dock Company, a Delaware Corporation having its principal place of business in Newport News, Virginia, U.S.A.

3. From 1962 to October 1968, he was responsible for and directed the activities of the Research Division of Newport News Shipbuilding and Dry Dock Company and specifically the program of investigating the technical and economic feasibility of deep ocean manganese nodule mining as conducted by that Company, during which time he served in the capacity of Director of Research and Assistant to the President (among other responsibilities) with continuous control over said ocean mining program and was responsible for planning, operations, budgeting and obtaining corporate support during the conduct of said program.

4. He prepared the documentation and directed the transfer of the interest of Newport News Shipbuilding and Dry Dock Company to Deepsea Ventures, Inc., a Delaware Corporation, having its principal place of business in Gloucester County, Virginia, U.S.A., in September of 1968, during which month both companies became subsidiaries of Tenneco, Inc., a Delaware Corporation having its principal place of business in Houston, Texas, U.S.A. The assets of said ocean mining program including, but not limited to, the Research Vessel PROSPECTOR, the trip reports, engineering reports, designs, notebooks, files and rights to the patents developed prior to said transfer date, were transferred from Newport News Shipbuilding and Drydock Company to Deepsea Ventures, Inc., along with certain personnel knowledgeable in the technical and business aspects of the program.

5. From October 7, 1968, until this date, he has served as President of Deepsea Ventures, Inc., and directed the continuation and expansion of the transferred program to prove the technical and economic feasibility of deep ocean mining, said program including the prospecting and exploration of the deep ocean floor of the Pacific Ocean, the development and testing of components and mining systems, and the development and testing of processes for winning the metals from manganese nodules, and he directed the preparation of summary resources data, engineering reports, filing of patent applications, and the economic analysis of a proposed commercial deep ocean mining system.

6. As a result of the foregoing activities, attention was concentrated in the California Seamount area of the Clarion Fracture Zone of the Baja California Oceanographic Province, identified during cruises of R/V PROSPECTOR (owned by Deepsea's predecessor in interest) during August 1964 and April/May 1965. Further cruises based thereon resulted, on August 31, 1969, at 1820 local time, in recovery of a particularly significant grab sample of nodules from a station at 15°28' N. Latitude 125°00.5' W. Longitude. Survey activity on this cruise continued as far south as 15°12.5' N., 125°02' W.

7. Since August 31, 1969, further surveys during 16 cruises, of three to four weeks duration each, have further defined the extent of the deposit discovered on that date. These activities included the taking of some 294 discrete samples, including the bulk dredging of some 164 tons of manganese nodules from some 263 dredge stations, 28 core stations and three grab sample stations, cutting of some 28 cores, approximately 1,000 lineal miles of survey of sea floor recorded by television and still photography, etc. As a result, the deposit of nodules (hereinafter "Deposit") identified with the discovery has been proved to extend generally throughout the entire area encompassed by lines drawn as follows:

From: (1) Latitude 15°44' N., Longitude 124°20' W. A line drawn West to: (2) Latitude 15°44' N., Longitude 127°46' W. And thence South to: (3) Latitude 14°16' N., Longitude 127°46' W. and thence East to: (4) Latitude 14°16' N., Longitude 124°20' W. And thence North to the point of origin including approximately 60,000 square kilometers, lying on the seabed of the abyssal ocean, in water depths between 2,300 to 5,000 meters. This Deposit is some 1,300 kilometers from the nearest continental margin, and some 1,000 kilometers from the nearest island.

8. Principal characteristics of the Deposit, based upon data acquired to date, are:

Average Assay, percent (dry weight) :

Manganese -----	29.0
Nickel -----	1.28
Copper -----	1.07
Cobalt -----	.25
Iron -----	6.3
Average population (percent) -----	30-40
Average concentration (wet) kg/meter ²) -----	9.7

9. It has been determined, after more than 10 years of exploration and survey, at-sea equipment testing and mineral and metal processing development, that deposits of manganese require tailoring the design of the mining and processing systems for each specific deposit, that geographic location, sea floor topography, sea floor sediment properties, nodule size, grade and concentration variation and nodule chemistry are sufficiently different so as to make a mining and processing system, which is based on one deposit, suffer important economic penalties if utilized for another deposit.

10. To this end dredge heads and mining systems have been designed by Deepsea Ventures, Inc., for the specific sediments, nodule properties, and water depths at, over and/or under the Deposit, and process design and pilot plant operations have been tailored to the nodules of grade and chemical composition of the manganese nodules in the Deposit. The cost to date of prospecting, exploration, design and test efforts required to identify and evaluate the potential of the Deposit has been approximately U.S. \$20,000,000. Further exploration, evaluation, and development of the Deposit and associated facilities will consume some three years and cost between U.S. \$22,000,000 and U.S. \$30,000,000. Such further exploration, evaluation and development of the Deposit commenced on 1 November 1974.

11. Deepsea intends to commence commercial production of the Deposit within 15 years at an initial rate of approximately 1.35 million wet metric tons of manganese nodules per year, which rate may be expanded according to market conditions to as much as 4 million wet metric tons per year. The Company intends to process said nodules at a land-based processing plant which will yield as the products thereof copper, nickel, cobalt and manganese and other products.

(signed by) JOHN E. FLIPSE,¹
President, Deepsea Ventures, Inc.

EXHIBIT D

SWORN STATEMENT

COMMONWEALTH OF VIRGINIA, U.S.A.,

County of Gloucester, ss:

Raymond Kaufman, being duly sworn, deposes that:

1. He resides at 112 Cove Road, Williamsburg, Virginia, U.S.A., and that he is a citizen of the United States of America, and that he is 48 years of age.

2. From December 1968 to 15 November 1974, he served as Vice President Technical to Deepsea Ventures, Inc., a Delaware Corporation having its principal place of business in Gloucester County, Virginia, U.S.A.

3. During this period he directed the technical activities of Deepsea Ventures, Inc., associated with ocean mineral deposit prospecting and surveying, mining equipment development and mineral processing development.

4. Commencing November 1, 1974, he has directed and will direct a technical program of Deepsea Ventures, Inc., to develop and evaluate a potential Pacific Ocean manganese nodule deposit described in the affidavit of Mr. John E. Flipse, dated November 15, 1974 (hereinafter "Deposit"), which will take and use from 1.35 to 4 million wet metric tons of manganese nodules per year for a 40-year period. This development and evaluation program will be accomplished in three principal phases:

PHASE I—DEPOSIT EVALUATION

The objective of this Phase is to confirm that the Deposit contains sufficient ore reserves in a favorable oceanographic environment to support the mining and processing operation for a period of 40 years. Phase I is being conducted over an approximate three-year period and will require 15 to 30 course grid survey cruises by the Company's R/V PROSPECTOR to acquire the data required to assess the economic potential of the Deposit. The acquisition of bulk samples from the Deposit will be achieved as a product of a pilot-scale mining ship/system test to be conducted on the Deposit. The estimated expenditure on activities directly related to, or at the site of, the Deposit during Phase I will be approximately U.S. \$22,000,000 to U.S. \$30,000,000. Subsequent evaluations of the Deposit will be conducted to define technical details necessary for mining.

¹ The signature was duly notarized.

PHASE II—INITIAL MINE DEVELOPMENT

The objective of this Phase (which may commence during Phase I above) is to develop a detailed plan to mine the Deposit effectively. This will require a comprehensive fine grid survey effort to map the sea floor, to provide topographical maps with a contour interval approaching one to ten meters, to locate obstructions and to determine ore distribution, concentration and assay variations for use in developing an effective mining plan for the Deposit. The work will be accomplished over a three-year period during which time data will be acquired, reduced, analyzed and evaluated. Due to the very large areas involved, the detailed fine grid survey of the entire Deposit will be completed in Phase III (below). The survey and analysis work in Phase II will be conducted over an area sufficient to provide ore for about three years mining at rates of 1.35 million wet metric tons of manganese nodules per year. The anticipated expenditure at the site of the Deposit is U.S. \$10,000,000 to U.S. \$15,000,000 during the first three years of Phase II.

PHASE III—INCREMENTAL MINE DEVELOPMENT/RECONNAISSANCE SURVEYS DURING COMMERCIAL PRODUCTION

The principal objective of this Phase is to continue the fine grid mining plan development, while concurrently mining successive tracts of a size blocked out as described in connection with Phase II. Mapping will proceed at a rate needed to provide mining data for at least one year's activity about three years in advance of the actual mining. In addition, a secondary objective of this Phase is to conduct broad area reconnaissance and prospecting surveys aimed at discovering additional ore bodies for future growth and expansion. This work will be undertaken as a continuing activity over the whole period of exploitation and production.

5. The survey and mine site development and evaluation program is one segment of an ocean mining technical development project which also includes the development of the mining, transportation and support, and ore processing segments. The technical and economic development of these elements is critically related to the properties of the specific deposit regarding sea floor engineering parameters, terrain, water depth, nodule character, distribution and assay, geographic location and chemical composition. The Phase I and Phase II expenditures previously referred to, do not include the costs of production mining equipment, ships, terminals, or processing plants. These latter costs are currently projected to exceed U.S. \$120,000,000, and are scheduled to commence on completion of Phase I.

6. Deepsea intends to mine the Deposit at an initial rate of approximately 1.35 million wet metric tons of manganese nodules per year, which rate may be expanded to as much as 4 million wet metric tons per year. The Company intends to process said nodules at a land-based processing plant which will yield as the products thereof copper, nickel, cobalt and manganese and other products.

(Signed by) **RAYMOND KAUFMAN**,¹

Vice President, Deepsea Ventures, Inc.

EXHIBIT E

NOTICE LIST

True copies of the "Notice of Discovery and Claim of Exclusive Mining Rights and Request for Diplomatic Protection and Protection of Investment, by Deepsea Ventures, Inc.", dated 14 November 1974, to which this notice list is appended as Exhibit E, shall be mailed by certified or registered airmail, return receipt requested, postage and certification or registration fee prepaid, by Deepsea Ventures, Inc. to each addressee listed in this Exhibit E. In addition, legal notice shall be published in as many of the following locations as is possible and practicable: Washington, D.C., U.S.A.; London, United Kingdom; Bonn, Germany; Paris, France; Moscow, U.S.S.R.; Tokyo, Japan; Ottawa, Canada; Brussels, Belgium; Caracas, Venezuela; Monrovia, Liberia; Singapore; New Delhi, India; Canberra, Australia; Tai Pei, Taiwan; Gloucester Point, Virginia and Wilmington, Delaware.

¹ The signature was duly notarized.

- The Honorable Frederick B. Dent, Secretary of Commerce, Department of Commerce, Fourteenth Street between Constitution Avenue and E Street, NW., Washington, D.C. 20230.
- The Honorable James R. Schlesinger, Secretary of Defense, Department of Defense, The Pentagon, Washington, D.C. 20301.
- The Honorable Rogers C. B. Morton, Secretary of Interior, Department of Interior, C Street between 18th and 19th Streets, NW., Washington, D.C. 20240
- The Honorable William E. Simon, Secretary of the Treasury, Department of the Treasury, Fifteenth Street and Pennsylvania Avenue, NW., Washington, D.C. 20220.
- The Honorable Henry A. Kissinger, Assistant to The President for National Security Affairs, National Security Council, Executive Office Building, Washington, D.C. 20506.
- The Senate Committee on Interior and Insular Affairs, c/o Senator Henry M. Jackson, Chairman, Room 137, Old Senate Office Building, Washington, D.C. 20510.
- The Senate Committee on Interior and Insular Affairs, Subcommittee on Minerals, Materials, and Fuels, c/o Senator Lee Metcalf, Chairman, Room 427, Old Senate Office Building, Washington, D.C. 20510.
- The House Committee on Merchant Marine and Fisheries, c/o Representative Leonor K. Sullivan, Chairman, Room 2221, Rayburn House Office Building, Washington, D.C. 20515.
- The House Committee on Merchant Marine and Fisheries, Subcommittee on Oceanography, c/o Representative Thomas N. Downing, Chairman, Room 2135, Rayburn House Office Building, Washington, D.C. 20511.
- The Honorable H. Guyford Stever, Director, National Science Foundation, 1800 G Street NW., Washington, D.C. 20550.
- The Honorable Kurt Waldheim, Secretary General of the United Nations, the United Nations, New York 10017.
- Dr. Maurice Rattray, Head, Department of Oceanography, University of Washington, Seattle, Wash. 98195.
- Dr. John P. Craven, Dean of Marine Programs, University of Hawaii, Honolulu, Hawaii.
- Dr. W. A. Nierenberg, Dean and Director, Scripps Institution of Oceanography, P.O. Box 109, La Jolla, Calif. 92037.
- Mr. Manik Talwani (Interim Director), Department of Geology, Lamont Doherty Geological Observatory, Columbia University, New York, N.Y. 10027.
- Dr. Paul M. Fye, President and Director, Woods Hole Oceanographic Institute, Woods Hole, Mass. 02543.
- Office of the Ambassador, Embassy of Australia, 1601 Massachusetts Avenue, Washington, D.C. 20036.
- Office of the Ambassador, Embassy of Belgium, 3330 Garfield Street, Washington, D.C. 20008.
- Office of the Ambassador, Embassy of Bulgaria, 2100 Sixteenth Street, Washington, D.C. 20009.
- Office of the Ambassador, Embassy of Canada, 1746 Massachusetts Avenue, Washington, D.C. 20036.
- Office of the Ambassador, Embassy of Czechoslovakia, 3900 Linnean Avenue, Washington, D.C. 20008.
- Office of the Ambassador, Embassy of France, 2535 Belmont Road, Washington, D.C. 20008.
- Office of the Ambassador, Embassy of Federal Republic of Germany, 4645 Reservoir Road, Washington, D.C. 20007.
- Office of the Ambassador, Embassy of Great Britain, 3100 Massachusetts Avenue, Washington, D.C. 20008.
- Office of the Ambassador, Embassy of Hungary, 2437 15th Street, Washington, D.C. 20009.
- Office of the Ambassador, Embassy of Japan, 2520 Massachusetts Avenue, Washington, D.C. 20008.
- Office of the Ambassador, Embassy of Poland, 2640 16th Street, Washington, D.C. 20009.
- Office of the Ambassador, Embassy of Union of Soviet Socialist Republics, 1125 16th Street, Washington, D.C. 20036.
- Tenneco Ocean Metals Development Corp., c/o Tenneco Corp., P.O. Box 2511, Houston, Tex. 77001. Attention: Mr. S. Askin, President.

- Japan Manganese Nodule Development Co., Ltd., c/o Nichimen Co., Ltd., Natural Resources Development Division, 11-1, Nibhonbashi, 3-chome, Chuo-ku, Tokyo, Japan 103. Attention: Mr. S. Hiraoka, Executive Vice President (JAM).
- Japan Cotton Co. (Nichimen Co., Ltd.), P.O. Box 1247, Dallas Tex. 75221. Attention: Mr. H. Nakahara, President.
- C. Itoh & Co., Ltd., Mineral Resources Development Department, 4, 2-chome, Honcho, Nibonbashi, Chuo-ku, Tokyo, Japan.
- Kanematsu-Gosho, Ltd., Non-Ferrous Metals Department, 5, Takara-cho 2-chome, Chuo-ku Tokyo, Japan.
- Union Mines, Inc., c/o Union Miniere, Department Investissements, Rue de la Chancellerie 1, B-1000, Brussels, Belgium.
- E. H. Tuck, Esq., Sherman & Sterling, 53 Wall Street, New York, N.Y. 10005.
- Essex Iron Co., Room 2786, 600 Grant Street Pittsburgh, Pa. 15230. Attention Mr. Phillips Hawkins, President.
- Amaz, Inc., 1270 Avenue of the Americas, New York, N.Y. 10020. Attention Mr D. J. Donahue, President.
- American Smelting & Refining Co., 120 Broadway, New York, N.Y. 10005. Attention Mr. R. L. Hennebach, President.
- Arbeitsgemeinschaft Meerestechnisch Gewinnbare Rohstof, D-300 Hannover 1, Postfach 4827, Arnstrasse 1, Federal Republic of Germany.
- The Broken Hill Proprietary Corp., Ltd., Central Research Laboratories, shortland, N.S.W. 2307, Australia. Attention: Dr. J. B. Lean, Research Manager.
- Cnexo (Centre National Pour L'Exploration des Oceans), Centre Oceanologique de Bretagne, B.P. 337, Brest 29N., France. Attention: Mr. Charles Christian Charles.
- Consolidated Gold Fields Ltd., 49 Moorgate, London EC2R 6BQ, England. Attention: Mr. J. D. McCall, Chairman.
- Demag AG, 41 Duisburg, Wolfgang-Reuter-Platz, Federal Republic of Germany, Attention: Dr. H. G. Sohl, Chairman.
- Deep Ocean Mining Association, c/o Sumitomo Metal Mining Co., Ltd., 5-11-3, Shinbashi, Minatoku, Tokyo, 105, Japan. Attention: Mr. Kenjiro Kawakami, Chairman.
- Deep Ocean Mining Association, c/o Sumitomo Metal Mining Co., Ltd., 5-11-3, Shinbashi, Minatoku, Tokyo, 105, Japan. Attention: Mr. Shō Takano, Secretariat.
- Dome Mines, Ltd., 360 Ray St., Suite 702, Toronto, Ontario, Canada. Attention: Mr. J. B. Redpath, President.
- Ethyl Corp., 330 South Fourth Street, Richmond, Va. 23219. Attention: Mr. B. C. Gottwald, President.
- General Crude Oil Co., Box 2252, Houston, Tex. 77001. Attention: Mr. D. E. Montague, President.
- Global Marine, Inc., Global Marine House, 811 West Seventh Street, Los Angeles, Calif. 90017. Attention: Mr. R. F. Bauer, Chairman of the Board.
- International Nickel Co. of Canada, Ltd., Toronto-Dominion Centre, King and Bay Streets, Ontario, Canada. Attention: Mr. J. E. Carter, President.
- Kennecott Copper Corp., 161 East 42d Street, New York, N.Y. 10017. Attention: Mr. F. R. Milliken, President.
- Lockheed Missiles & Space Co., Inc., Sunnyvale, Calif. 94088, Attention: Mr. Stanley W. Burriss, President.
- Marubeni, 3-3, Hommachi, Higashiku, Osaka 541, Japan. Attention: Mr. Hiro Hiyaama, President.
- Messerschmitt-Bölkow-Blohm GmbH., 8012 Ottobrunn Bei München, Federal Republic of Germany. Attention: Office of the Chairman.
- Metallgesellschaft Aktiengesellschaft, D-6000 Frankfurt 1, P. O. Box 3724, Reuterweg 2-32, Federal Republic of Germany. Attention: M. H. Ley, Chairman.
- Mitsubishi Corp., 2-6-3, Marunouchi, Chiyodaku, Tokyo 100, Japan. Attention: Chujiro Fujino, President.
- Mitsui & Co., 1-2-9, Nishi-Shinbashi, Minatoku, Tokyo 105. Attention: Mr. Yoshizo Ikeda, President.
- NL Industries, Inc. (formerly National Lead), 111 Broadway, New York, N.Y. 10006. Attention: Mr. R. C. Adam, President.
- Noranda Mines, Ltd., Bank of Nova Scotia Building., 44 King Street West, Toronto 1, Canada. Attention: Mr. A. Powis, President.
- Rheinische Braunkohlenwerke Aktiengesellschaft. D-5000 Köln 1, P.O. Box 10 16 66, Konrad-Adenauer-Ufer 55, Federal Republic of Germany. Attention: Office of the Chairman.

- Rio Tinto-Zinc Corp. Ltd., 6 St. James' Square, London SW1Y 4LD, England.
Attention: Sir J.N.V. Duncan OBE, Chairman.
- Salzgitter Aktiengesellschaft, D-3320 Salzgitter 41, P.O. Box 41 11 29, Federal Republic of Germany. Attention: Office of the Chairman.
- Summa Corp., Ocean Mining Division, P.O. Box 99006, Houston, Tex. 77011.
Attention: Mr. P. G. Reeve, General Manager.
- Sumitomo Ocean Development & Engineering Co., Ltd., 2-2, 1-chome, Hitosubashi, Chiyoda-ku, Tokyo, Japan. Attention: Mr. J. Tamura, Managing Director.
- Sumitomo Shoji Kaisha, Ltd., 5-15, Kitahama, Higashiku, Osaka 541, Japan.
Attention: Yukio Shibayama, President.
- Superior Oil Co., First City National Bank Building, Houston, Tex. 77002. Attention: Mr. H. B. Keck, President.
- Teck Corp., Ltd., Suite 4900 (P.O. Box 49), Toronto-Dominion Centre, Toronto 1, Ontario, Canada. Attention: Mr. N. B. Keevil, President.
- August Thyssen-Hütte AG, 41 Duisburg-Homborn, Kaiser-Wilhelm-Strasse 100, Postfach 67, Federal Republic of Germany. Attention: Dr. D. Spethmann, President.
- Occidental Minerals Corp., 6073 West 44th Avenue, Wheat Ridge, Colo. 80033. Attention: Mr. P. A. Bailly, President.
- Ocean Resources, Inc., P.O. Box 2244, La Jolla, Calif. 92037. Attention: Dr. John Mero, President.
- Placer Development Ltd., 1030 West Georgia Street, Vancouver 5, B.C., Canada. Attention: Mr. T. H. McClelland, President.
- Phelps Dodge Corp., 300 Park Avenue, New York, N.Y. 10022. Attention: Mr. G. B. Munroe, President.
- Preussag Aktiengesellschaft, D-300 Hannover 1, P.O. Box 4829, Leibnizufer 9, Federal Republic of Germany. Attention: Mr. G. Sassmannshausen, Chairman.
- Utah International, Inc., 550 California Street, San Francisco, Calif. 94104. Attention: Mr. A. M. Wilson, President.

APPENDIX F

U.S. Department of State : Statement on Claim of Exclusive Mining
Rights by Deepsea Ventures, Inc.



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STATEMENT ON CLAIM OF EXCLUSIVE MINING RIGHTS BY DEEPSEA VENTURES, INC.¹

The Department of State received on November 15, 1974, a letter from Mr. John E. Flipse, President of Deepsea Ventures, Inc., described as a "Notice of Discovery and Claim of Exclusive Mining Rights and Request for Diplomatic Protection and Protection of Investment, by Deepsea Ventures, Inc." This claim identifies an area in the eastern Pacific Ocean that is beyond the national jurisdiction of any state and asserts that Deepsea Ventures, Inc. "has discovered and taken possession of, and is now engaged in developing and evaluating, as the first stages of mining a deposit of seabed manganese nodules." Deepsea Ventures asserts the exclusive rights to develop, evaluate and mine the deposit and to take, use and sell all of the manganese nodules in, and the minerals and metals derived therefrom.

The Department of State does not grant or recognize exclusive mining rights to the mineral resources of an area of the seabed beyond the limits of national jurisdiction.

The appropriate means for the development of the law of the sea is the Third United Nations Conference on Law of the Sea and not unilateral claims. The United States supports the achievement of a widely acceptable and comprehensive law of the sea treaty in 1975 that would include a regime and machinery for the exploration for and exploitation of the mineral resources of the deep seabed beyond the limits of national jurisdiction.

The position of the United States Government on deep ocean mining pending the outcome of the Law of the Sea Conference is that the mining of the seabed beyond the limits of national jurisdiction may proceed as a freedom of the high seas under existing international law.

¹ Statement made available by the U.S. Department of State. Reproduced from the text provided by the U.S. Department of State. This statement was made available following the filing of the Notice with the U.S. Secretary of State, as a guidance paper for response to press inquiries.

101.